

System 400

FAST Computing on Wheels

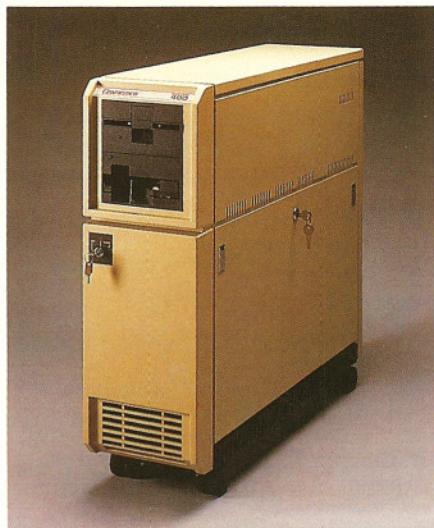
Cromemco recently introduced the System 400, a new high-performance, high-capacity super-microcomputer that provides exceptional capability and cost effectiveness.

In making the announcement, Dr. Harry Garland, Cromemco president, stressed the significance of the system: "This system benefits from the cumulative knowledge we have gained over the past ten years. Customers have asked for more RAM capacity, large hard disk back-up, cartridge tape back-up and other features, all of which are standard on the System 400."

Description

The convenient roll-around packaging of the System 400 provides an attractive, unobtrusive system that is ideal for the professional working office environment. Its rugged design provides a dependable, capable system for high-performance requirements.

The CS-400 is available in a wide number of standard configurations. Standard configurations can be selected from models with 4Mb or 8Mb with up to 16Mb of error-correcting RAM. There is a choice of a single 140Mb disk drive or dual 140 megabyte disk drives for 280Mb of high-speed hard disk. These disk drives are controlled by the STDC high-speed controller with cache memory.



The system comes with a standard 5 1/4-inch floppy disk drive (390K bytes capacity) for program interchange and a 32 megabyte cartridge tape drive for program or data backup.

Designed for high board content, 21 board slots are provided for expanding or configuring the system to meet any particular set of needs. It features a rugged power supply (with 50% more capacity than the one in the System 300), and a high performance cooling system that uses four high-volume fans. Therefore, the CS-400 has the cooling capacity to handle a full load of boards, and a high ambient temperature if necessary. Each of the CS-400 models is available in versions for 110 vac, 60 Hz, or 220 vac, 50 Hz.

The System 400 is available in two different series, depending on the operating system provided. The X-Series is supplied with UNIX System V and Cromix-Plus. The XC-Series is supplied only with Cromix-Plus.

Fast UNIX

The standard UNIX System V supplied with the X-Series System 400 is especially configured to take advantage of the large amount of available RAM memory. This is achieved by allocating a full 750K bytes of RAM as a buffer area. For many jobs, this will greatly reduce the number of disk accesses required, and thereby substantially increase the speed of the system.

Central Processor and Memory Manager

The central processor of the System 400 is the XPU, a high-performance 32-bit processor board. An XMM memory management board is included with the X-Series machines but not the XC-Series (not required by Cromix). With UNIX the processor works in conjunction with the XMM memory management board to provide demand-paging memory management (with 4k pages), and many advanced features, such as scatter loading, that increase processing speed and optimize memory utilization. Context switching is done in a single instruction time for fast response when switching from user to user or from task to task. The result is that multiple users can be added to the system with

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Improving WORDSTAR Performance under CROMIX

by Bob Staudenmaier

For those of you who haven't already tried, Wordstar™ does execute under the CROMIX Operating System. However, performance is a little sluggish, especially when more than one user is running.

The standard delays Micropro uses (located at 02CFH) are much too long for CROMIX and need to be shortened. Also, Wordstar performs a lot of screen manipulations and updating. Console output under the CDOS simulator is too slow to do the screen updates very quickly. Wordstar also makes very frequent console status checks to avoid "losing" characters typed at the terminal. The frequent status checks slow down the screen updating and fail to

Continued on page 26

What Determines System Performance?

by Charley Dobson

Cromemco users have come a long way from the days when a Cromemco System Two with 32K of RAM and an 82K floppy disk with CDOS was a big step up from cassette tape systems. Today many Cromemco users have 512K or more of RAM and 21 megabyte hard disks with CROMIX. Many owners find that these improved systems can be shared by a number of users. As a result, they are constantly looking for ways to gain maximum performance from each system so that it can support as many terminals as possible. Several of our customers would like to have 20 to 30 users on their present system by the end of this year. These customers may not welcome the suggestion that the number of users be reduced to improve performance. However, a second system can provide a practical solution in cases where the work can be divided. In other cases, some suggestions

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ANNOUNCING!!

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Software Standards announces their new line of RealWorld accounting packages for operation under Cromemco's new UNIX System V machines. These packages are written in powerful High-Performance Micro-Focus cobol and utilize their new super high-speed NATIVE-CODE GENERATOR. All packages are optimized for speed and support the full multi-user record level locking features of UNIX System V.

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Contact your Cromemco dealer for more information. If you don't have a Cromemco Dealer, contact Software Standards for the name of the dealer nearest you.



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Location of Directories (B: -Z:) — can be specified in another environment file (.profile) using full 128 byte Cromix path names. A

default directory (/lib/ovr) is always searched after the specified directory if a file is not found.

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Printer Spooling — Spooling to the printer device can be enabled with the keyboard or an environment file.

EOF Characters (^Z) — are eliminated from the end of user disk files.

Input Line Editing — As you enter a line of data, the simulator allows interactive editing (exchange, deletion, or insertion) and/or recall of up to 255 lines from the circular line buffer.

Command Function Menu — allows the user to branch to our command menu and selectively change the environment features. In addition the **Fork to a Shell** makes it convenient to leave a program, work on other files and reenter the program where you left it.

Used properly these enhancements will give you greater control and flexibility with your system.

Call for more information — Dealer Inquiries Invited.

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I/O News

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input ...

Editor:

Since 1977 I have owned a Z-2D computer and it's still running quite well. I do the hardware maintenance myself (I am an EE), so the computer costs virtually nothing to run. I rely heavily on test programs and a few instruments that I can borrow. I have bought the System Diagnostics Software from Cromemco for this.

I subscribed to SUDS for this product and got no update during the last year. I would have hoped to have received one test program for each of the new Cromemco boards, because Cromemco must have them to test the boards and to validate a custom configured system.

What is Cromemco's policy with respect to test programs for the end user?

Sincerely yours,
Alberic Muller
Member No. 469, Switzerland

Dear Mr. Muller:

In seeking an answer to your question I contacted Mr. Ted Maciejewski, the Manager of Technical Support at Cromemco. His response proved to be very enlightening.

It turns out that Cromemco utilizes a vast array of machines to perform testing of board components. He referred to these as 'DTS Fixtures.' The diagnostic software for this test equipment is in ROM. They have a variety of ROMs for testing the numerous board components, and merely interchange ROM chips to test different chips. The completed boards are tested on other machines.

Preliminary and final testing is performed with the boards in place in a working computer system. Here, other diagnostic software comes to bear, as well as general operation under an operating system.

So, a good deal of the testing done at the factory requires specialized equipment which is not generally available to end-users.

As to the reasons that your hopes were not realized, well, the lag between the introduction of new boards and the complementary diagnostic software is a problem that they are working very hard at solving.

I was informed that at present there are a number of new diagnostic programs being evaluated in-house. The greatest hindrance to their being released is the lack of documentation. Clearly written, complete documentation takes time to write, and always seems to be put off until last. Releasing the software without documentation would in all likelihood result in greater disrepair than repair.

Nevertheless, new diagnostic soft-

ware for the DPU, XPU, and X-Series boards should become available by June of '85. Time will tell.

The question as to what to do in situations where a SUDS subscriber does not receive any updates during the course of the year is still open, and is being studied.

Ed.

Editor:

Perhaps you could assist us with the following problems:

1. When starting two large FORTRAN programs from two terminals on one system, the run of one program is often aborted. Example: Cromemco Z-2 with 1 MByte (2 x 512 MSU), 2 Terminals on IOP/QUADART, and one on a 64FDC under CROMIX 20.63.

The programs were compiled with 68000 FORTRAN 2.14 by help of segmentation. The first results in a 50K bin file, the second is 96K.

Each program runs separately on a 0.5 MByte system without troubles; they also run together on another multiuser system (like PRIME) with no problems.

One is started on QTTY2; a few seconds later the other on QTTY3. TTY1 is not used. Approximately 30 seconds later, on QTTY3, the following error message occurs:

Program aborted Address error at location 0 542AC, status register 0000 instruction 2149, fault address 090009, status word 2141

The program on QTTY2 seems to run correctly.

Question: What could we do to avoid such influence from one program on another? What is wrong?

2. Recently, the error "Disk read error" has occurred a few times on our HD-20. Following re-initialization a "Read error: alternate track register" message appears.

First question: What is the correct action after this message?

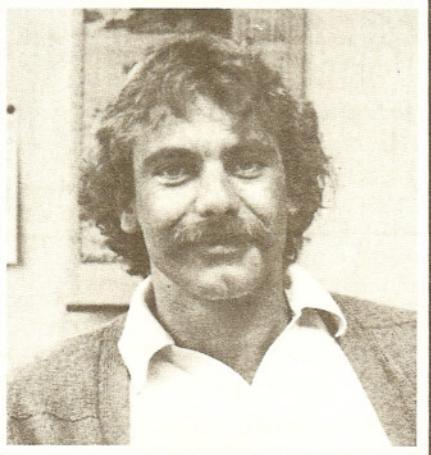
We would like to update the HD-20 to HD-21, but we now feel insecure about whether the mechanical part of the drive is OK.

Second question: Is there, from the above described error message, any indication of a disk-drive fault, and if not, how can we ascertain whether the drive is in order and worth updating?

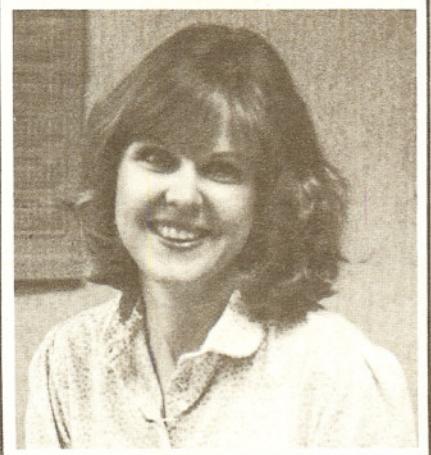
Yours faithfully,
I. Uherkovich
VSL INTERNATIONAL Losinger, Ltd.,
Switzerland
Member Number 02654

The problems expressed by Mr. Uherkovich are exemplary of the sometimes mysterious maladies that can infect our computers. Many of us have had similar experiences. Despite the mystery, there are rational explanations, and reasonable cures. Jerry Adams, Technical Manager for the Cromemco Eastern Regional Office, offers his diagnosis and treatment for the situation noted above in this issue's Tec Tips column.

Ed.



William Jaenicke



Lynn Platzek

Asynchronous Serial Communications under CROMIX

by Gerald R. Reynolds

Asynchronous serial communications may be done through any serial port of a CROMIX system. The key to success lies in two areas: using a non-interactive port; and getting the mode settings right. The reason that the communication port must be non-interactive is that the login and shell processes enforce certain mode settings that conflict with the settings that must be used for the port, so these processes must not be active on the port.

An interactive port can be made non-interactive by changing the first byte of its entry in the /etc/ttys file to 0 and informing CROMIX of the change. KILL -1 1 will do this, but only if the mode of the terminal is set to ABortenable.

Mode settings that should be used whether sending or receiving are -ABortenable -CRDEVice DELAYcode 0 -ECho EVenparity -FFexpand -FNkeys -IMmediateecho -LCase ODDparity -PAuse -TABexpand and Width 0. Also, the baud rate must be properly set. Other settings may be task-dependent. (Some of these settings may not be necessary for sending, particularly if sending only all-ASCII text files).

In addition to the above settings, the sending mode may need to include CBreak. The CROMIX manual states that the sending mode should include RAW, but it must *not*, if XON/XOFF protocol is being used, else it will treat XON and XOFF as ordinary data rather than control characters, with resulting data loss.

In addition to the above settings, the receiving mode should include TANdem and RAW. TANdem enables XON/XOFF protocol; the receiver automatically sends these signals as necessary. If some other protocol is to be used, TANdem mode should be set off.

Once the modes are set, the receiving process must be started before the sending process. *copy* may be used for both sending and receiving. It should be run in background or detached mode for receiving. The command to copy from port qtty1 to the file *textfield.txt* in the current directory would be:

```
copy -d /dev/qtty1 textfile.txt &
```

This will report a PID number and return control to the Shell prompt. The receiving process will not terminate because a port has no end-of-file, and with the RAW mode set, does not sense *ctrl-z* as EOF. When data transfer is finished, the process must be killed, which is why it should be run in background mode. *kill nnn*, where *nnn* is the PID number of the process, will kill it. (Killing the process may change the mode settings).

The sending process may be run in either detached or interactive mode. The command to copy from the file *datafile.dat* in the current directory to port qtty1 in interactive mode would be:

```
copy -f datafile.dat /dev/qtty1
```

The sending process will terminate normally at end-of-file.

To test the setup a file can be sent out one port and in another, or even back in the same port. If the same port is used for both sending and receiving, the mode should be CBreak and not RAW. The ports should be connected by a null modem cable (which, if they are close enough, can be just a paper clip or two!). If the same port is used for both sending and receiving, a paper clip or jumper from pin 2 to 3 is sufficient. Following the above examples, the command line would be:

```
copy -d /dev/qtty1 textfile.txt & copy -f datafile.dat /dev/qtty1
```

When the sending process finishes, the receiving process must be killed. Then the file received may be compared to the one sent. They should match exactly. If they do not, check first that the file sizes are identical. Making the hookup may have placed a character or two of garbage on one of the ports, which would be at the beginning of the received file. If this happens, just delete the receive file and try again. This time the files should match.

If the file being sent contains certain control characters or non-ASCII data, there may be problems transmitting it unchanged. Study carefully the effects of the BiNary, CBreak and RAW modes. It may, for example, be necessary to use the BiNary mode, but this disables TANdem mode, so that XON/XOFF protocol cannot be used. It may not be possible to select a low enough baud rate to prevent data loss in this case. It may be necessary to use block communications protocol or the uncode/recode utilities.

When data transmission is finished, to make a non-interactive port interactive again it must be restored to active status in the /etc/ttys file with a 1 in the first byte of its entry in that file, and CROMIX must be informed of the change. KILL -1 1 will do this if, as noted above, the mode of the port is set to ABortenable. Then the port can be reconnected to an interactive terminal and its mode set as desired for interactive use.

About the Author

Gerald R. Reynolds is the D.P. Manager and Chairman of the Science Faculty at Helderberg College, P.O. Box 22, Somerset West 7130, Republic of South Africa, Telephone: 27010.

We're Interested!

We're Really Interested...in what you have to say. Especially about how you use your system...the problems encountered and the solutions effected...unusual uses or environments...and any practical applications you would be willing to share with fellow members. These can be short notes for departments like 'bits & bytes...' and 'Tec Tips,' or full feature articles.

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ProLink even transcends its remote communications capabilities with utilities to control the C-10 real-time clock, reboot from the keyboard, password protect against unauthorized use and provide binary and ASCII file transfers. And, ProLink is compatible with existing BASIC software written for use under "BYE", another popular communications package.

ProLink is available for C-10's (release 5 and above) running CDOS 3.07.

For more information on these and other products by ProtoMatrix Software Development, contact your local Cromemco dealer or write: PSD, 12564 Connemara Way, Sunnyvale, CA 94087.

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A CDOS Application Program Written in C

by Jordan Siedband

In my callow, naive, pre-'C' days, I wrote client applications programs using 32K Structured BASIC primarily because of the KSAM application libraries contained in it. However much I prefer CROMIX, some of my clients still have CDOS. One such auto dealer uses a System-III with dual 8-in DSDD floppy diskettes. The B-drive has been configured to accept 512 entries. The auto unit entries consist of 5 numeric characters. All other entries are utility programs. In addition, the names are kept in a KSAM file with other crucial indices. For some unknown reason, these KSAM files get corrupted from time to time, and it becomes necessary to recreate them. In order to rebuild the file the directory entries must be placed in a file, car.fil which may be used to rebuild the KSAM file.

Almost everyone will admit that Cromemco's documentation for 'C' is very sparse, and CDOS interfacing even sparser. Perhaps the lessons shown in the program will help you in solving similar problems, too.

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```
/* fixcars: rebuild look-up table car.fil (J.Siedband) 5/14/84 */
#include <cdstdio.h>
#include <z80regs.h>
#include <cdoscalls.h>
#include <dos.h>

/* directory structure:
   Byte          Contents
   ===          =====
   0           Special: bit
   7-  erase protected
   6-  write protected
   5-  read protected
   4-  system file attribute
   3-  user file attribute
   2-  extended file format
   1-  not used
   0-  either erased file if byte= E5H
        or      disk label if byte = 81H

   1- 8          Filename
   9-11         Filename Extension
   12          Extent Number
   13          Not used
   14          Record Count in Last extent (For Hard Disks Only)
   15          Record Count
   16-31         Cluster Numbers */

char  matrix[512][6];          /* sorting matrix          */
char  name[14];                /* program name           */
char  *first="?????????????";  /* file control block     */
char  fcb[33],*fcptr;          /* file control block     */
char  *ptr,retval;
char  *ctl="%s\n";
char  *filename="car.fil";
File  *fp;

main()
{
    int    flag,fn,i,j,k,n;
    char  *temp;

    fn=creat(filename,0);
    close(fn);
    fp=fopen(filename,"w");

    rhl = first;    /* format file control block */
    rde = &fcb[0];
    rc = _cdformfcb;
    ccdos(_r);
    printf("REGENERATING CAR FILE      CAR.FIL\n");

    ptr=get1st();
    i=j=k=n=0;
    do
    {
        if (name[9] != ' ')
        {
            k=12;
            for (i=0;i<3;i++)
                name[k]=name[--k];
            name[9]='.';
            for (i=k;0;i<13;i++)
                if (name[i] != ' ') name[k++]=name[i];
            for (i=k;i<14;i++) name[i]=' ';
        }
        for (i=flag=0;i<12;i++) putchar(name[i+1]);
        /* skip if 1st char is E5h or 81h */
        if (name[0]=='\201' || name[0]=='\345') flag=1;
        /* skip if directory entry non-numeric */
        if (name[1]<'0' || name[1]>'9') flag=1;
        if (flag==0)
        {
            for (i=0;i<5;i++) matrix[n][i]=name[i+1];
            printf("\tStored");
            matrix[n++][5]='\0';
        }
        ptr=getdir();
        putchar('\r');
        putchar('\n');
    }
    while ( retval != '\377');      /* \377 = OFFh = -1 means EOF */
    for (i=0;i<5;i++) matrix[n][i]='0';
    matrix[n][5]='\0';
    printf("\n\nSORTING\n");
}
```

```

/* matrix now loaded, close directory, sort & print to buffer */
/* shell sort for strings */
for (k=n/2;k>0;k /= 2)
    for (i=k;i<n;i++)
        for (j=i-k;j>0;j-=k)
        {
            if (strcmp(matrix[j],matrix[j+k]) <=0)
                break;

            for (flag=0;flag<6;flag++)
            {
                temp=matrix[j][flag];
                matrix[j][flag]=matrix[j+k][flag];
                matrix[j+k][flag]=temp;
            }
        }
printf("\r\nWRITING TO CAR.FIL\r\n");
for(i=0;i<=n;i++)
    fprintf(fp,ctl,matrix[i]);
fprintf(fp,ctl,"    ");
fclose(fp);
}
strcmp(s,t)
char s[],t[];
{
    int i;

    i=0;
    while (s[i]==t[i])
        if (s[i++] == '\0')      return(0);
    return(s[i]-t[i]);
}
char *getdir()
{
    /* returns pointer to directory entry */
    fcptr=&fcb[0];
#control basm
    EX    DE,HL
    LD    C,12H           ;call for next directory entry
    CALL   5               ;make CDOS CALL
    LD    DE,name
    LD    BC,13
    LDIR
    LD    {retval},A
#control easm
}
char *get1st()
{
    /* returns pointer to directory entry */
    fcptr=&fcb[0];
#control basm
    EX    DE,HL
    LD    C,11H           ;call for first directory entry
    CALL   5               ;make CDOS CALL
    LD    {retval},A
    LD    DE,name
    LD    BC,13
    LDIR
    LD    {retval},A
#control easm
}

```

About the Author

A long-time member and contributor, Jordan Siedband will soon be retiring (at an early age) from his post as Professor of Mathematics and Physics at Harper College, Illinois. He will be pursuing his interest in computers as an independent computer consultant specializing in Cromemco systems. His vast experience with Cromemco hardware and software, combined with his background in mathematics, uniquely qualify him for consulting and programming projects of a custom nature in the fields of business, science, and engineering. Mr. Siedband can be contacted by phone at: (312) 276-0401.

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Inside CROMIX

Inside CROMIX is an open forum on both eight-bit and 16-bit versions of CROMIX. The subject matter is directed towards helping CROMIX users derive more from their systems. Members' contributions are invited. **Inside CROMIX** is edited by William Jaenicke, Technical Editor of I/O News. Mr. Jaenicke has been involved with Cromemco systems and CROMIX for the past five years as an independent software consultant. He is available for consultation on CROMIX and can be reached by phone at (714) 955-0432.

One of the most powerful and useful features of CROMIX (and UNIX) is the ability to connect the output of one process to the input of another. The mechanism by which this is accomplished is referred to as a pipe. In this installment of Inside CROMIX we will examine pipes from two levels: the high-level, everyday type usage; and the low-level, assembly language methods employed by system programmers. Thanks goes this issue to Adrian Pickering of the Microcomputer Centre at the University of Dundee for his "technical memo" regarding the CROMIX channel system.

An Introduction to Pipes

In its simplest form, a *pipe* is a channel connecting the output of one process to the input of another. Visually, you can think of a pipe as just that, a literal pipeline between two separate and independent programs or tasks. More specifically, a pipe enables you to redefine the standard input and the standard output of two processes. By making the standard output of one process the standard input of another, you thereby "connect" them. The connection is a pipe, symbolically represented as a vertical bar, |.

Normally the standard input of a process is the console (terminal). Thus, when you run an application program, such as the SCREEN Text Editor, input is supplied by the user typing at the terminal. Similarly, the standard output is defined to be the console. So you see what is being typed on the terminal screen.

The CROMIX manual offers little in the way of explanation and examples regarding pipes. Therefore, the many ways in which pipes may be employed to assist the CROMIX user may not be apparent. A simple example, provided by the CROMIX manual, shows how to spool a directory listing to the system printer:

```
| spool
```

In this instance, the output of the list command is connected to the input of the spool utility. Thus, instead of the directory listing appearing on the screen, it is spooled to the printer.

I frequently utilize pipes to "drive" the SCREEN editor. Imagine that you had a large number of files, all of which required the same type of modification. For the sake of example, assume that the files are dBASE command files and you wish to replace all occurrences of complete dBASE commands with their four-letter equivalents. Thus, you would like to see the command ENDDO replaced with the shorter ENDD, ENDIF replaced with ENDI, RESTORE replace with REST, and so on. The purpose of this would be to reduce the size of your command files.

Without the pipe capability you would have no choice but to SCREEN each file, and repeatedly use the REPLACE function to effect the desired changes. This is obviously a time consuming, repetitive, and tedious task. It would be so much easier if only you could enter the set of repetitive keystrokes once, and have SCREEN "look" into that file to get its input. Using a pipe you can do just that.

The first step is to create a file containing the exact set of keystrokes that you would enter if you were operating the SCREEN editor from a terminal. The desired replacements would be made by repeatedly Jumping to the Beginning of the file, calling the global (-) Substitute command (without Query), providing the appropriate arguments, i.e., the string to search for and the string to replace it, and finally, Exiting and Updating the file. The file to effect the three substitutions noted above, call it *squeeze.txt*, would look like:

```
jb#/s/ENDD//ENDD/jb#/s/ENDIF//ENDI/jb#/s/RESTORE//REST/eu
```

Note that there are no carriage returns used in the file. This is because SCREEN recognizes its commands by a single character, and does not require you to terminate the command with a return. Thus, the file coincides exactly with the stream of characters you would enter from the terminal to command SCREEN to make the desired changes. The character sequence jb is the SCREEN command for Jump to Beginning; the #s specifies a global substitution sans Query; the [/search sequence]/[replace sequence]/ specifies the character sequence to search for and character sequence to replace the located characters, respectively. At the end of the file are the SCREEN commands to Exit (e) and Update (u) the file.

Armed with our *squeeze.txt* file, we can easily modify our dBASE command file, *prog1.cmd*, with the following command:

```
ty squeeze.txt | screen prog1.cmd
```

assuming that both *squeeze.txt* and *prog1.cmd* are in the current directory. If not, absolute pathnames of the files could be used. As you know, the *ty* command types the named file to the console (standard output). But by using a pipe, we have connected the standard output of the *ty* command to the input of SCREEN. So as far as SCREEN is concerned, it is as though someone is sitting at the console typing the characters. On the console you would see SCREEN's distinctive display, the file *prog1.cmd*, and the stream of commands, one at a time, magically appearing. And it would all be happening very fast.

We can easily expand this capability by writing a command file to handle more than one file. The command file */cmd/squeeze.cmd* might look like:

```
%squeeze.cmd—repetitively edit a list of dBASE command files
%more if .#1 = . goto done
ty squeeze.txt | screen #1
shift
goto more
%done
exit
```

We could then edit a list of files with the command:

```
squeeze prog1.cmd prog2.cmd prog3.cmd ... progx.cmd
```

Finally, since we know the command file works, and there is no reason to sit and watch SCREEN do its thing, and also because we want to do other work, we could have the whole operation take place invisibly in background mode by making a slight change to one line of *squeeze.cmd*:

```
ty squeeze.txt | screen #1 > /dev/null
```

This change causes a redirection of SCREEN's output to the null device (bit bucket). Thus, it will not appear on the terminal. To get it running as a background process we would simply issue the command:

```
squeeze prog*.cmd &
```

where the & results in a process identification number being assigned to the task, runs it in background, and gives you a shell prompt from which you can do any other tasks you have at hand.

The above examples demonstrate the general strategy employed to have a program (SCREEN in this case) get its input from somewhere other than the keyboard. The same principles apply to any application program. For example, I use a

similar method for making mass updates of renewal codes in the IACU member database. It is quicker to supply the keystrokes for selecting the appropriate menu options and commands in a file, and to direct the database program to read its input from the file via a pipe in background mode. That allows me to do other work on the system at the same time. I'm sure you will find other uses that meet your own particular set of needs.

DUMC Technical Memo—No. 12 CROMIX PIPES

Summary

The CROMIX multi-tasking operating system offers the facility for two concurrent processes to send information to each other. The mechanism for this is provided in the pipe, which is a one-way communication channel linking one process to the other. This document aims to demystify the description in the CROMIX manual and deals with the setting up of a two-way communication path between two processes.

The CROMIX channel system

The CROMIX operating system treats all forms of I/O whether from a file, terminal, or peripheral in a similar manner and regards it as taking place through a channel which has a known channel number. Allocation of channels is done dynamically with a new channel request being assigned the lowest number channel that is available. Channels become available when these are closed by the .close command. Channel numbers start at 0, but the first three (0, 1, 2) have a special meaning: these are the standard input (stdin), the standard output (stdout) and the standard error output (stderr) channels, respectively, and are usually assigned to the console. When a new process is initiated from a console, stdin, stdout and stderr are inherited. If this process should in turn initiate a child process (using the .fexec or .fshell command), the child process will normally also inherit these channels until it is finished. What is required for inter-process communication is for the parent process to retain the standard channels and for it to communicate to its child through other channels.

Figure 1.

Implementation

The description of how a two way pipe may be set up by a parent to a child process now follows. In the diagrams, the arrows refer to flow of data, and the symbol ']' refers to a closed unallocated channel.

- i) Data flows into the channel
- ii) Data flows out of the channel
- iii) Unallocated channel.

1) The parent process is started; as usual this will inherit the standard channels.



Figure 2.

2) Now we call .pipe: this sets up a one-way pipe. The command returns two channel numbers in the b and c registers.

register b = output FROM the pipe
register c = input TO the pipe

The input to the pipe becomes the lower channel number of the two. The register values must be saved. Two pipes are needed so we call .pipe again, and again store the channel numbers. The names given to the pipe channels pertain to the example software listing in Appendix 1.

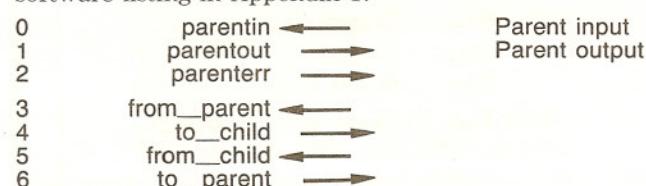


Figure 3.

3) Duplicates of channels may be made using .chdup. This utility allocates the lowest available channel, as usual. Now we duplicate the standard input and output channels so that there are in effect two copies of the parents' I/O.

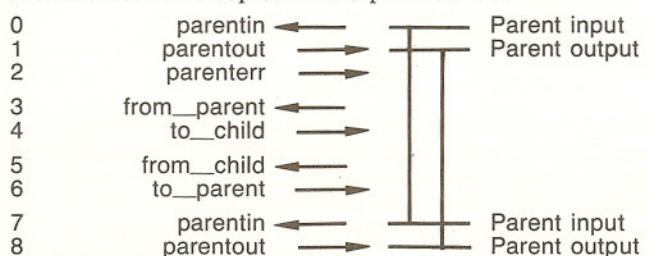


Figure 4.

4) Now we use the .close command to close the standard input and output channels. This removes one of the copies leaving the standard I/O clear and the parents' I/O through channels 7 and 8.

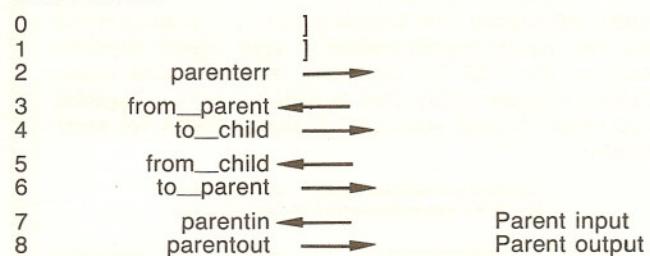


Figure 5.

5) Because the lowest available channel numbers are allocated when a request is submitted, calling .chdup with to_child as its argument will link this pipe channel to channel 0. Similarly, by now calling .chdup with from_child as its argument, a link between this pipe channel and channel 1 will be created.

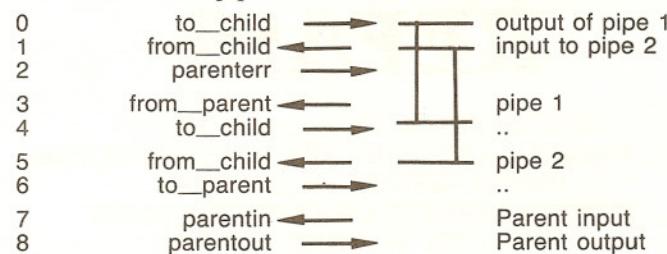
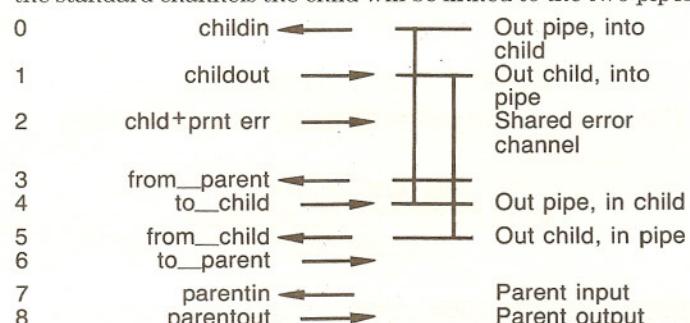


Figure 6.

6) Now the child process is started. Because the child inherits the standard channels the child will be linked to the two pipes.



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Figure 7.

7. Now the channels 0 and 1 are closed using .close, thus releasing these channels. Similarly, channels 4 and 5 are closed. This leaves the child process with two pipe ends exposed for communication.

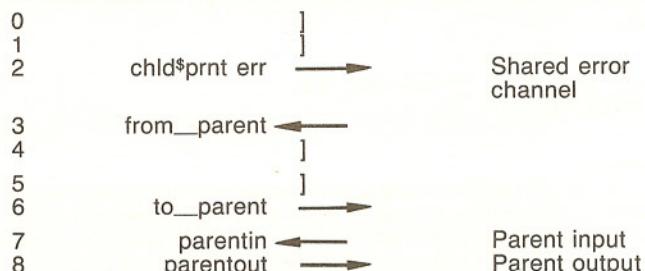


Figure 8.

8) Now the parents input and output is restored to the standard channels by .chdup.

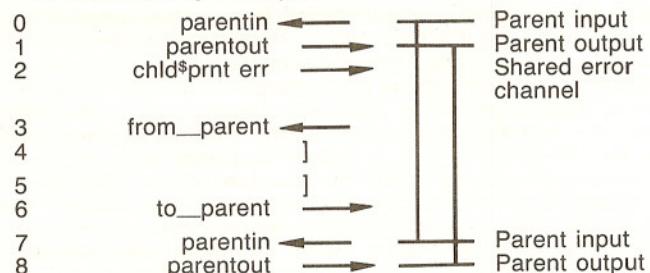
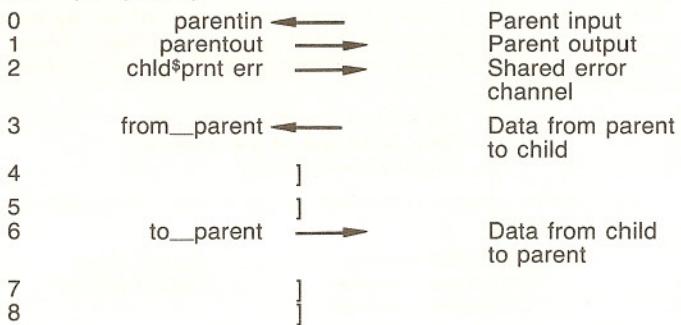


Figure 9.

9) In this final diagram the communication system is set up. The parents duplicate I/O channels have been closed and the parent may talk to the child by passing information down channel 3 (from _parent) and may receive information from the child from channel 6 (to_parent).



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Close Encounters of the C-10 Kind

Close Encounters of the C-10 Kind is a regular column directed to users of Cromemco's personal computer, the C-10. It is edited by Dr. Tom Beer, of Applied Environmetrics, located at 118 Gordon St., Balwyn, Victoria 3103, Australia. Dr. Beer can be reached by phone during business hours at (03) 817-2571.

Release 5 and 6

The much heralded Release 5 chip has finally reached all C-10 SUDS subscribers. Anyway, it has reached me. And if it has finally reached me in Australia, then I assume everyone else has already received it. The Release 5 CDOS started to appear in new C-10 machines from about July 1984 onwards, but SUDS subscribers were all sent Release 6, which incorporated the Release 5 hardware and new Release 6 software—mainly comprising a new update of Writemaster. The update notes alone totalled 26 pages of documentation and there was a new Writemaster manual in my update kit.

Cromemco originally offered all SUDS subscribers the choice of factory installation of the new hardware, dealer installation, or mailing it to the individual to install themselves. Like many amongst us, I had somehow got the impression that this would involve pulling out one or two IC chips, and replacing them with Cromemco supplied replacement IC's. If only life had been that simple. When the upgrade box arrived it had two resistors and two capacitors to install; 18 inches of jump wire to solder hither and yon; and 17 pages of Technical Bulletin explaining what was to be done. I shuddered and am awaiting a propitious conjunction of stars and planets before I attempt the upgrade.

Dr. John Parrish of Emporia State University, Kansas was more adventuresome. He writes . . .

I was amazed at the amount of electrical knowledge presumed by Cromemco in assuming that some C-10 owners might want to install the update themselves. Neither I nor my colleagues could have accomplished this trick without the expert help of a Ph.D. friend who has a degree in electronics. The main problem was the exceedingly poor reproductions of the circuit board drawings provided by Cromemco. Two of us received totally unreadable copies in our update kit. Fortunately, there was always at least one of the four which was decipherable. I had fun doing it and there was a certain amount of satisfaction that we were able to get the job done on all three of the C-10's that we updated . . .

The rest of Dr. Parrish's letter was about interfacing his Okidata 92 printer with Release 6 Writemaster. I have also received a note from Paul Shaw, Managing Director of Travads, a Sydney based Travel Advertising Service. Mr. Shaw's company uses a C-10 and he sent me a copy of a letter he wrote to Cromemco. I reproduce some of it below. Mr. Shaw says . . .

We set a limit of \$5000 for a system including software and a letter quality printer and I went to look at everything available in Sydney.

I found that all the hardware was great. It was reasonably priced, looked good and worked well.

What I didn't like was the software bundled with the hardware — Wordstar™ with Osborne, Perfect Writer™ with Kaypro, etc. There was no way that I was going to learn the numerous command codes necessary to work Wordstar.

When I saw the Cromemco C-10 personal computer with the WriteMaster word processing it was love at first sight. I particularly liked the uncomplicated keyboard, large display and coordinated hardware, the menu operation, help function, and screen oriented software.

Our choice of the Brother HR-15 printer was a good one. Our dealer added a patch to our Writemaster program to enable underline, boldface, superscript and subscript printing. You will be pleased to learn that we have been very

happy with our Cromemco C-10 system.

One of our initial objectives with regard to copy preparation for typesetting has now been achieved. An Australian company in Melbourne has developed and marketed the Baber conversion unit which is a device used by typesetting suppliers to read data from microcomputer disks from which typesetting is produced.

After some consultation with the company in Melbourne, the Baber unit can now be programmed to read data from C-10 disks...

QUICK NOTES

1. Release 5 CDOS (ie. Version 3 CDOS) has altered the behavior of CDOS system call 8EH. Previous versions of CDOS left the A register unchanged after a cursor address sequence. The new CDOS returns zero in the A register after such a sequence.

2. Though the idea behind the Cromemco program DiskMaster™ is admirable, the program itself is very restrictive in the range of disks it can handle. My understanding is that C-10 CDOS still does not handle single sided CDOS disks and I would have expected this capability in DiskMaster. It is lacking. Some form of CROMIX to CDOS converter would also be nice and, presumably, something that the resident Cromemco software gurus could easily produce. Presumably the reason that these two nice features were not included is that nobody thought of it. [CROMIX does have the cdoscopy utility and can read from or write to CDOS disks. Ed.]

3. In regards to the C-10 Release 5 upgrade procedure, Ross Herbert has supplied a corrected version of the MOD sheet and diagrams, which can be obtained by contacting I/O News.

MAILBOX

Dear Dr. Beer:

Subject: Item for your column "Close Encounters of the C-10 Kind."

I do not subscribe to the I/O News, for it is too expensive and has too little for the C-10 users in it, so I do not know if you have already carried the following suggestion for C-10 users. Even if you have not, I would appreciate your running my request for a program tip which is at the end of this letter.

THE C-10 VERSION OF "HOME" OR "CLS" COMMANDS

C-10 users of SBASIC who want to try out computer graphics and kids' games in BASIC will discover to their dismay that unlike APPLE and IBM computers, the C-10 SBASIC has no simple command to clear the screen. It took me a long time to puzzle this out, since it is not in the SBASIC user manual index. It is in the C-10 Technical Reference Manual (p. 195) and can be sifted out of programs used to demonstrate graphics.

If your BASIC program calls for a HOME or CLS, enter two lines:

```
Ln LET ESC$=CHR$(27)  
Ln PRINT ESC$;"E"
```

This will clear the screen.

REQUEST FOR HELP:

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PROGRAM NEEDED: I need to sort a mailing list of under 100 names which have been coded with items like "1p" to represent "poet" and "184" which means the person attended our 1984 conference. What the program has to do is:

Ask me what word processing file I want to sort from. Open that file. Ask what code I want to use (e.g. !p for poet). Create a file to copy the selected items to. Name the new file. Go to the original file, FIND each name with the selected code, COPY that name to the new file, until all such coded names have been copied, then CLOSE the original file, SAVE the new file, and ask me if I want another.

Specialists tell me this is a simple program of about 50 lines. I'm neither a specialist nor a programmer. If this challenges anyone out there, I'd appreciate a public domain listing for my C-10.

Thanks!
Harley L. Sachs

Dear Mr. Sachs,

Thank you for your letter. The delay between submitting material to I/O News and seeing it in print is horrendous, and rather than have you wait, I thought I should reply directly to your letter.

Firstly, in relation to the total outlay on a C-10, the cost of subscribing to I/O News is not large. I know that though originally I felt exactly the way that you did — extra cost was just too much to bear having just paid out for the C-10 — I now believe that I/O News is trying hard to cater to more C-10 owners. Because I also felt that it did not have enough about the C-10, I offered to do a C-10 column. The magazine is run as a member's magazine and can only publish member contributions, so that if more C-10 owners write articles there will be more about the C-10 in the magazine.

In fact, there is more C-10 related material in I/O News than you might realize. The 32K Classroom column is directly applicable, and in recent issues there have been articles on C-10 external port allocations, a review of ProCall (a communication package for the C-10), and there have been software listings for the C-10.

I mentioned the screen clearing trick in my first C-10 article (*I/O News Volume III, No. 6*). It is an important point and one well worth making again. Incidentally, homing the cursor without clearing the screen can be done by:

PRINT ESC\$;"H"

To program, say, Control-I, to function as a Clear Screen key would require the following program to be inserted into an SBASIC program (Appendix F of the technical manual has other control codes):

```

10 Rem—Control-I sends two characters: Ascii 2 and Ascii 112
15 Rem—so we must dimension Keyin$ for two storage spaces
20 Dim Keyin$(1),Esc$(0),Clsc$(1)
25 Esc$=Chr$(27)
30 Rem—The clear screen function follows
35 Clsc$=Esc$+"E"
40 Rem—Channel zero always receives input from the console
45 Get0$Keyin$
50 Rem—The semicolon after Clsc$ insures cursor does not
55 Rem—go to new line.
60 If(Asc(Keyin$)=2)And(Asc(Keyin$(1,1))=112) Then@Clsc$;
65 Stop

```

As to your final request in relation to that program, your specialist friends are correct. The program is one that you would find useful to program yourself. You have done the most difficult part, which is to set out each step of the desired program in a clear and logical manner, and you would find that an elementary knowledge of Cromemco SBASIC and its file handling capabilities would enable you to complete the coding. Such a knowledge may be obtained from either the Basic Primer and Basic Teacher which are sold as part of the Applied Environmetrics C-10 Fun Disk (US \$100), or from the book and disk combination "An Introduction to Structured BASIC for the C-10" (\$57 + \$3 post + tax) distributed by The Software Hill.

Addresses:

The Software Hill, 1857 Apple Tree Lane, Mountain View, CA 94040

Applied Environmetrics, 118 Gordon St., Balwyn, Vic 3103, Australia

Yours sincerely,
Tom Beer





tec·tips

Tec Tips is a regular column aimed at providing hints for keeping systems up and running. It will not attempt to deal with specific engineering applications or non-standard configurations. **Tec Tips** is edited by Richard Quinn, owner of QUINTEC, a Southern California Computer service firm.

Editor's Note:

Due to an extremely busy schedule, Richard Quinn was unable to write this Tec Tips column. Still there are tips to be had: some notes on the STDC from Issue No. 102 of the Cromemco NEWS for OEM's and ISO's, and Jerry Adams' reply to Losinger (see INPUT).

STDC COMPATIBILITY

There have been several changes made to the STDC disk controller board since it was originally introduced. This article explains the various revisions.

Evolution of STDC Versions

The original STDC (Rev. C, P/N 5420-0138), as shipped, was designed to work with both the DPU and the XPU boards. If required, the STDC could be modified to work with the ZPU by changing a few jumpers.

However, limitations of the board layout caused internal shorts to develop, which prevented this modification from working properly. It was necessary to make significant modifications to the board by cutting traces and adding jumpers and components. Once these changes were made, the STDC could no longer work with either the XPU or the DPU with a simple jumper change. Therefore, a separate product number was established for an STDC that was used with the ZPU only (Rev. C, P/N 520-0138-1).

When the speed of the XPU increased to run at a 10MHz rate, it was again necessary to modify the original STDC for use with the 10MHz XPU. This modification created the STDC/XPU, an STDC that would work with both the 10MHz XPU and the DPU boards (Rev. C, P/N 520-0138-2).

As these modifications were made, they were made to each board version as if it were a separate product. Therefore, different versions were modified separately, which explains why each of the STDC versions has a different mod level.

Current STDC Versions

The most recent release of the STDC is Rev. D, which can eliminate much of the confusion for new orders. The standard board works with both the DPU and the XPU boards and is ordered by specifying Model No. STDC.

For use with the ZPU board, the board can be modified with a few simple jumper changes, which are described in the STDC manual. Or, the STDC can be purchased already modified for operation with a ZPU by specifying Model No. STDC-Z. These are the only two versions of the STDC that are now being shipped.

The following chart summarizes the STDC versions.

STDC COMPATIBILITY CHART

ORDER NO.	STDC REV.	STDC MOD LEVEL	COMPATIBLE WITH:	P/N REF.
..	C	13	DPU only	520-0138
..	C	8	ZPU only	520-0138-1
..	C	9	DPU or XPU	520-0138-2
STDC	D	3	DPU or XPU	520-0138-2
STDC-Z	D	3	ZPU	520-0138-1

** Not available for new orders; superseded by STDC and STDC-Z.

STDC Priority Interrupt

There have been some questions about where in the priori-

ty interrupt chain to put the STDC. If IC38 is 502-0123-1, the STDC can be anywhere in the priority interrupt chain. If, on the other hand, IC38 is 502-0123, it should be last in the priority interrupt chain.

Another point of consideration is in which pin of the priority connector on the STDC is 'in' and which is 'out'. On Rev C STDC's the left-hand pin is 'in' and the right-hand pin is 'out'. This is the reverse of the other boards we make. With the release of the Rev D STDC the connector has been changed to be in line with our other boards. In other words, the right-hand pin is 'in' and the left-hand pin is 'out'.

During April we will be switching to a keyed connector on the priority interrupt cable to minimize the possibility of the cable being installed incorrectly.

RESPONSE TO INPUT

In this issue's INPUT column, one of our members described a number of technical problems which they were experiencing. The letter was forwarded to Jerry Adams at the Cromemco Eastern Regional Office. His reply follows.

1. The problem that the FORTRAN programs are having could arise from many sources. I have listed them in order of decreasing probability.

A. You may have a problem in a section of memory that is only used when both programs are running. Please note that the size of the .bin file is only the amount of code and initialized variables. To this is added initialized variables and stack space. Please see the attached note to determine the size of a 68000 program. The config utility will give you an approximate size.

B. It is also possible for memory boards to fail in such a manner so that changing the data in location X also changes the data in location Y. This would also account for your failure.

C. Use of the POKE subroutine with an incorrect address may inadvertently modify the operating system or other programs.

2. In both cases 1A and 1B above, a memory test program should be run (usually overnight) and may find the problem. In the case of 1C, you must look carefully at your code.

3. Regarding disk read errors, this is typically caused by an electrical transient in the system. Some possible sources are:

- A. Loose key switch on CS-1.
- B. Intermittent power connector on hard disk.
- C. Ground loops via RS-232 terminal cables.
- D. Static discharge.
- E. Poor building ground.

To restore the disk:

- A. Run hdtest.com and Write All of the disk.
- B. Run init.com and re-initialize.
- C. Run hdtest.com, Test the WDI, then do Random Seek, Write for at least 12 hours and copy down the cylinder (track) and surface (head) of the errors.
- D. Run init.com to re-initialize, and enter the cylinders and surfaces in the alternate track table.

To test a disk drive for reliability:

1. Allow the system to warm up at least thirty minutes.
2. a. Initialize the disk.
b. Make sure that all known bad tracks are entered in the alternate track table.
3. a. Run the diagnostic (hdtest or STDEX).
b. Select the drive.
c. Read the alternate track table.
d. Test the controller (WDI or STDC).
e. Test with random seek, write for at least 12 hours.
f. Stop, and ask for an error list. You should have no fatal errors and only 1 or 2 system errors for any one track and head. If this is the case go to step 4. If not, go back to step 2b.
4. Re-initialize the drive, and use it.
5. Before using the system, please run at least two passes of a memory test, also.

```
C      HOW MANY ARGUMENTS ARE THERE?  
      ARGC=IARGC()  
      IF (ARGC .LT. 1) GOTO 800  
      ARGCNO=0  
100   ARGCNO=ARGCNO+1  
      CALL GETARGC(ARGIN, FNAME)  
      OPEN(5,ERR=801,FILE=FNAME,STATUS='OLD',ACCESS='DIRECT',RECL=4)  
C      IF THE FIRST 4 BYTES OF THE FILE ARE C7, C7, 00, 00 THEN  
C      ASSUME IT IS A 68,000 BINARY  
      RECNOC=1  
      READ(5,REC=RECNOC,ERR=802) DATA  
      IF(DATA .NE. -943259648) GOTO 802  
C      GET THE SIZE DATA FROM BYTES 8, 9, A, & B  
      RECNOC=3  
      READ(5,REC=RECNOC,ERR=802) DATA  
      GOTO 803  
C      ERROR, NO ARGUMENTS  
      800  WRITE(1,900)  
      GOTO 860  
C      ERROR, CANNOT OPEN THE FILE  
      801  WRITE(1,901) FNAME  
      GOTO 860  
C      ERROR, DOES NOT APPEAR TO BE A 68,000 BINARY PROGRAM  
      802  WRITE(1,902) FNAME  
      GOTO 850  
C      OK, PRINT THE MEMORY REQUIREMENTS  
      803  WRITE(0,903) DATA, FNAME  
      850  CLOSE(5)  
      860  IF (ARGIN .LT. ARGC) GOTO 100  
900  FORMAT('! ERROR: The correct syntax is "SIZE filenlist"')  
901  FORMAT('! ERROR: Cannot open file ',1A48)  
902  FORMAT('! ERROR: Not a 68,000 binary ',1A48)  
903  FORMAT(1X,1I9,' bytes required for ',1A48)  
END
```

PROGRAM SIZE

```
C      THIS PROGRAM DISPLAYS THE MEMORY REQUIREMENTS OF A  
C      68,000 BINARY PROGRAM IN DECIMAL BYTES.  
C      5 APRIL 1985, BY JERRY ADAMS AT CROMEMCO, INC., BOSTON, MA  
C      THE PROGRAM IS CALLED BY THE COMMAND "SIZE FILENAME"  
C      CHARACTER*80 FNAME  
C      INTEGER*4 RECNOC, DATA  
C      INTEGER ARGC, ARGCNO  
C      INTEGER*1 CRC(22)  
C      THE FOLLOWING DATA ALLOWS VERSION TO SET A CRC  
C      HEADER. FD ED FD ED <-CRC-> Rel Ver  
C      DATA CRC /-3,-19,-3,-19,0,0,0,0, 01, 01,  
C      ASCII S i z e 0 1 . 0 1 NL NUL  
1      83,105,122,101,32,48,49,46,48,49,10,0/
```

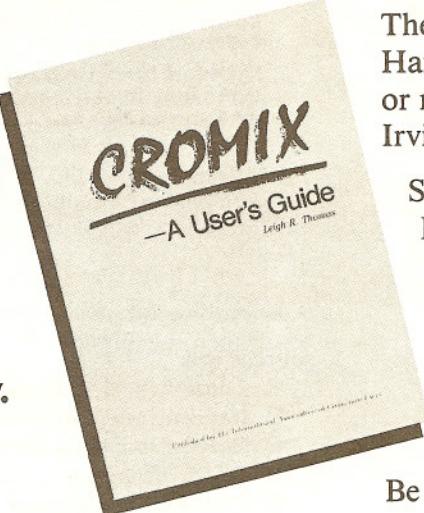
```
† Special command file to compile and link a 68000 FORTRAN program called SIZE  
† 4 April 1985, Jerry Adams, Cromemco, Inc., Boston, MA  
/usr/pkg/ford/fortran SIZE -lSIZE.1st  
if -err exit  
/usr/pkg/ford/code SIZE.i  
if -err exit  
† new stack size .....  
/usr/pkg/ford/crolinker -h$100 SIZE -lSIZE.map /usr/lib/ftnlib /usr/lib/paslib  
if -err exit  
version -c size.bin  
version size.bin  
access re.re.re size.bin  
chowner system size.bin
```

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New Product Announcements

NEW CROMIX-PLUS OPERATING SYSTEM

Cromemco introduced a new version of 68000 CROMIX, called CROMIX-PLUS, that provides a number of enhancements over D-Series CROMIX and much faster performance.

The improvements are the result of a two-year effort at Cromemco, during which time the CROMIX kernel was completely rewritten in 'C'. Only critical parts of the operating system are still written in machine code. In the process, several routines have been improved, resulting in better performance. The 'C' language allows the operating system to be customized much more easily than previous versions of CROMIX.

Speed improvements are particularly notable. Some functions, such as pipes and simple system calls, show speed improvement of 200% to 300% over D-Series CROMIX. At least a 30% speed improvement can be expected in most programs running with CROMIX-PLUS.

Several significant differences between CROMIX-PLUS and earlier versions of CROMIX are responsible for the improved performance. The CROGEN utility has been expanded, allowing the user to define the number of process tables. Thus, more processes can be run simultaneously than ever before. CROGEN also allows you to specify the number of users, open files, mounted devices, file locks, memory resident inodes and data blocks.

CROMIX-PLUS has the capability to read UNIX-formatted diskettes directly through the use of an alternate floppy disk driver. This is useful in transferring files between CROMIX and UNIX, and in insuring improved compatibility with UNIX in the future.

Programs can allocate and deallocate 4K blocks of memory by virtue of a new system call. Also, memory is now allocated by 68000 programs in blocks of 4K instead of 64K, allowing more efficient memory usage. A new utility, ramdisk.bin enables you to dynamically allocate memory for RAM disk in blocks of 4K instead of 64K. You no longer need to specify the size of RAM disk during system generation.

Several existing utilities have been improved. mount.bin allows specified non-privileged users to mount disks, under control of a file set by the system administrator. spool.bin allows files to be spooled, but not printed until the proper paper has been installed in the printer. This is controlled by mode.bin which is used to set the required form. Also, mode.bin can now be used on block devices. This includes the capability to disable disk verify for high performance applications.

An added benefit is the completely rewritten and extensive documentation available for CROMIX-PLUS. This in-

cludes a new introductory manual entitled "Introduction to CROMIX-PLUS," the "CROMIX-PLUS User's Reference Manual," the "CROMIX-PLUS Programmer's Reference Manual," and the "CROMIX-PLUS Administrator's Guide."

The current version of CROMIX-Plus is version 30.79. This release includes a new program, called rcopy, which supports the Cromemco CTD and TDS tape drives. Users should be aware that CROMIX-PLUS will not support the WDI-II controller, and there is no plan to do so in the future. As speed improvement is a primary feature of CROMIX-PLUS, it supports only the faster STDC controller.

Software Update Service:

Because CROMIX-PLUS does not support the WDI-II controller it is not being offered as a direct replacement of CROMIX-D. Cromemco will, however, continue to support both operating systems. As a special accommodation to the CROMIX-D SUDS subscribers, notification was made in January giving them the option to upgrade their software.

CROMIX-PLUS is available now as a separate product, part number CRO-PLUS-S/L, at a suggested U.S. list price of \$595.

INTRODUCING THE XC-SERIES

The Cromemco System 100 and System 300, like the new System 400, are now available in CROMIX-only versions. These new systems offer the performance of the new CROMIX-PLUS operating system, with the 10 MHz XPU processor, at a price significantly below the X-series machines. These new machines are designated as the XC-Series.

The XC-Series machines are designed to give the ultimate in performance in the CROMIX environment, and can be easily upgraded to UNIX by the simple addition of an XMM memory management card and the installation of the UNIX operating system (both available from Cromemco).

Each system includes a 10 MHz, 68000-based XPU processor, fast STDC hard disk controller, 64FDC floppy disk controller, 21 megabyte hard disk, and either one megabyte or 2 megabytes of RAM in the basic system. The new CROMIX-PLUS operating system is also included as part of the package price.

For information on pricing, contact your local Cromemco dealer, or Cromemco.

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Applied Environmetrics has made a selection of the best of the CP/M public domain software and adapted the programs to work on the C-10. The pro-

grams are grouped in Volumes, and each volume relates to one specific function (Games, Communications, File and Directory Utilities, Assembler, BASIC, etc.) and are offered for \$25 each.

Volumes are still being prepared.

Those presently available are:

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THE CONNECTABLES™

Touchstone Software Corporation has announced the release of three exciting products that go a long way toward eliminating compatibility problems between various personal computers, while providing an easy-to-install and easy-to-use network capability. All of this is done through software and standard RS-232 serial interfaces; no special hardware is required.

Presently, there are three separate software packages: PCworks™ for the IBM PC, MacLine™ for the Apple Macintosh, and UniHost™ for UNIX and CROMIX.

When used alone, both PCworks and MacLine enable their respective personal computer to act as a remote terminal to another computer system. The software is menu-driven, and takes advantage of the graphics capabilities of the respective machines (as well as the Mac's mouse). All details involved in communicating with other computer systems are handled by the software. The Main Menu can be modified by each user to preset the telephone numbers, communication line parameters, terminal options, and other variable information used with specific systems.

When used in conjunction with the UniHost software, true networking capabilities such as mail exchange, file transfer between remote systems, and access to remote printers become possible. In these cases, the UNIX or CROMIX system acts as the file handler and server, transferring files between remote systems, or acting simply as an archive backup. All file transfers are guaranteed to be error-free, using The Connectables communication protocol which features automatic error detection and correction.

Prices and Availability

PCworks and MacLine are available in a "combined" version, which includes one copy of the personal computer programs (PCworks or MacLine) and one copy of the UNIX UniHost program for \$495. MacLine can also be licensed separately for \$195, and UniHost can be licensed separately for \$295. PCworks is licensed for \$195 per copy.

PCworks is available from Cromemco as model number PCWORKS-X with a

list price of \$495.

For further information contact:

TouchStone Software Corporation
909 Electric Avenue, Suite 207
Seal Beach, California 90740
(213)598-7746

EXCALIBUR UTILITIES FOR CROMIX SYSTEMS

Excalibur Software announced its release of the Excalibur Utilities for Cromemco CROMIX Systems. Some of the programs in the package include:

Shell — Replaces the Cromemco Shell.bin. Adds ..bin, ..cmd, /usr/bin and /usr/cmd to the search path. Args — Allows any command to become interactive by prompting for arguments.

Sim — Replaces the Cromemco Shell. Allows you to fork a shell from .com programs, print to a selected device besides /dev/prt, and speeds up programs which constantly poll the screen.

Event — Allows the user to set up and run programs at specified times. Events can be set up to run at periodic intervals.

Call — A command file which allows you to use Procall in the format "Call John." This calls John and logs you in.

Pmatch — Works similar to the CROMIX match except it prints the entire paragraph.

Menu — Allows you to make CROMIX easier to use. Each user can have a custom menu which is easy to set up and is FAST. The Screen format is not fixed, it can look exactly the way you want it to.

Timer — Allows the user to time any event. We use it to time compiles, logon time, programmer time, and program run times.

Append — Used in conjunction with pmatch. Allows the user to quickly append new information to the end of the file.

Chtime — Allows a user to change any of the times or dates associated with his files.

Datediff — Given two dates, it computes the number of days between them. Given one day and a number of days, it computes the second date. Great for computing interest or finding out how many days till school's out.

Rpn — For those of you who wish that more calculator manufacturers would use reverse polish logic, the perfect calculator for you. For those who would like the regular calculators, calc will soon be available.

Print — For those of you considering or who have already purchased a Hewlett-Packard LaserJet Printer, this program allows you to take advantage of its many features. It allows you to use Wordstar-like dot commands to set margins, page lengths, print lists, merge letters and more. Will be modified to run on other "advanced" printers in the near future. If you are interested in this printer, Excalibur offers them for \$2,995. Usual retail is \$3,495.

Several more utilities are in progress. Most notably, appt, an appointment

scheduler and reminder. Anyone buying these utilities will receive all updates for a full year.

The Excalibur Utilities are only \$149 and be obtained from:

Excalibur Software
4548 Auburn Blvd., Suite 191
Sacramento, California 95841

UNIX SOFTWARE EMERGING

Large amounts of UNIX software are now becoming available for Cromemco X-Series systems. These include:

APGEN

APGEN, from the Software Express, is an advanced Application Generator which allows the use to dramatically reduce the cost and time required to produce and document commercial application software. The APGEN products formatted for Cromemco can be ordered directly, from Software Express by writing or calling:

The Software Express, Inc.
2925 Briarpark Drive, Suite 700
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713/974-2298
800/231-0062

Thoroughbred Software

The Thoroughbred Accounting Software System, from SMC Software Systems, is available for Cromemco X-Series systems. This includes General Ledger, Accounts Payable, Accounts Receivable, Purchase Order, Order Processing, Payroll and Fixed Assets. For further information contact SMC directly at:

SMC Software Systems
1011 Route -22
Bridgewater, NJ 08807
201/685-9000
800/526-3968

Q-OFFICE

Q-Office software, from Quadratron Systems, Inc., provides a completely integrated word processor, electronic calendar, calculator, menu generator, memo generator, electronic mail and phone directory capabilities and is ideal for multi-user installations. It lists for \$1995 and can be ordered from Cromemco as part number Q-Plus-XS or Q-Plus-XL. Foreign language versions of the Quadratron software are being distributed by Arcad Technology AB, a Swedish firm specializing in foreign versions of general application programs for Cromemco computers. For further information regarding these versions contact Arcad directly at:

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32K Classroom

32K Classroom is a regular column aimed at explaining various programming techniques using 32K Structured BASIC. 32K Classroom is edited by Bernie Thomas of Jakes Manufacturing Corp., P.O. Box 23050, Nashville, TN 37202. Users are encouraged to submit examples of their own which may help others in understanding and using this powerful language. Editorial contributions should be sent to 32K Classroom in care of I/O News.

Editor's Note:

This is Part Two of Bernie's KSAM Manual. As you will recall from last time, we had set up a names1.kat file as our MASTER file. We constructed it from a pre-existing "regular" BASIC file (names.dat) by creating a program which sequentially read each record of the names.dat, created a "key" from the record number, and added the key and record to the newly kcreated names1.kat. The next task is to set up an "index" file from which we can generate a zip-code ordered mailing list ...

A KSAM MANUAL — PART II

names.kat will now become the MASTER FILE, and all other files which we kcreate will carry only a KEY from this file at its' records. To illustrate, let's write a program to kcreate a MAILING LIST by ascending zip code order.

```
100 On Error Goto 110: Erase "Names2.kat"
110 On Error Stop: Kcreate\4,40\ "Names2.kat"
120 Kopen\2\ "Names2.kat"
130 Kopen\1\ "Names1.kat"
140 Dim Name$(29), Add$(29), City$(19), State$(1), Zip$(9)
150 Dim Add2$(29), Key1$(3), Key11$(3), Key2$(39)
200 On Error Goto Finish
210 Kgetfwd\1\Name$, Add$, City$, State$, Zip$
220 On Error Stop
230 Kretrieve\1\Key1$
240 Key2$=Zip$+Name$
250 On Error Goto Check' for'duplicate
260 Kadd\2, Key2$(-1)\Key1$
270 On Error Stop
280 @Key2$: Goto 200
300 *Check' for'duplicate
310 Kgetkey\2, Key2$(-1)\Key11$
320 Kgetkey\1, Key11$\Name$, Add2$
330 If Add2$=Add$ Then Kdel\1, Key1$\: Goto 200
340 E=Len(Key2$)-1: Key2$(E,E)=Chr$(Asc(Key2$(E,E))+1)
350 Kgetkey\1, Key$\: Goto 250
400 *Finish: Close: Stop
```

Lines of code which have been explained in the first program will not be covered again. Refer to preceding explanations if needed.

LINE 200: When an attempt is made to read beyond the last record in a file, ERROR 163 will be reported. This is trappable and control will be transferred to *Finish.

LINE 210: Kgetfwd is used to read the next record in a KSAM file. When a KSAM file is opened, the pointer is at the beginning of the file. A Kgetfwd after a Kopen will read the first record of that file. Each time a Kgetfwd is encountered, the next actual record will be read.

LINE 230: Kretrieve allows you to read the KEY of the current record. In this example, we are setting Key1\$ equal to the actual KEY for the current record of the file on channel 1.

LINE 240: Sets Key2\$, which is the KEY to our new file, equal to the Zip Code plus the Name. Thus, not only will the records be ordered by zip code (primary sort), but within a zip code range they will also be ordered by name (secondary sort).

LINE 250: Since two records cannot have the same KEY, a KSAM Error 164 (Invalid Key) will be given if you try to Kadd a KEY which already exists in the file. The On Error Goto

Check'for'duplicate statement will trap this error and transfer control to Line 300.

LINE 260: Adds the new record to the file. Note the use of the (-1) in this case. Since Name\$ could be of various lengths, a combination of the Name and the Zip Code has produced a KEY which is likely to be less than 40 bytes. Therefore we must use Key2\$(-1). In the case of Key1\$, it will always be 4 bytes in length, and the (-1) is not necessary.

LINE 280: Transfers control back to the beginning of the loop at Line 200.

LINE 300: This is our Check'for'duplicate line label. If you are not familiar with the use of line labels, they can be very handy. In long programs they eliminate the hassle of remembering a line number. As you can see, the Label Name must be preceded by an asterisk (*). I have made it a habit to use uniform Labels such as *Loc, *Cr'tclear, etc., in all of my programs. It does a lot to speed up programming.

LINE 310: Reads the existing record which has the duplicate KEY to the record we are trying to add. We are asking for its key to the MAIN file so we can compare the addresses and determine if we have two different people with the same name and zip code, or duplicate records.

LINE 320: Reads the MAIN file for the address as explained above. Note that we have assigned the address of this record to variable Add2\$, and not Add\$, since we must retain Add\$.

LINE 330: If Add\$ is equal to Add2\$, then we have indeed found a duplicate record which the command Kdel\1,Key\$ will eliminate from our main file. Control is then transferred to Line 200 to Kget the next record. It is important to note that when a record is deleted, the CURRENT RECORD POINTER (CRP) is set to the previous record. This means that the next record at Line 210 will be the correct one.

LINE 340: If Add2\$ is not equal to Add\$, then the two records are not actually duplicates, but merely two people with the same name and zip code, and control is transferred to this line. We must now alter Key1\$ so it will not be a duplicate KEY to our new file, which is just what the two commands on this line accomplish. The first command assigns the position of the last byte of the string variable Key2\$ to the arithmetic variable E (one less than the length of the variable, since positions start at 0). The second command increments the last byte of Key2\$ to the next ASCII code. If, for example, Key1\$ were "37205Bernie Thomas" then it would become "37205Bernie Thomat", which the new file will accept. The record is placed immediately behind "37205Bernie Thomas" in the file. If there should happen to be a third Bernie Thomas with the zip code 37205, then it will be filed as "37205Bernie Thomau". A fourth would become "37205Bernie Thomav", and so forth.

LINE 350: Because we accessed the Main File in Line 320, the CRP is pointing to the record accessed, and not to the next record in sequential order. The first command on this line, Kgetkey11,Key\$, will reset the CRP to the correct record. The second command will transfer control back to Line 250, where it will then be Kadded, or rejected if it should happen to be a triplicate.

In the next installment we will explore various techniques for accessing the data in our file, and ways to search for specific records. Also, the KSAM facilities for maintaining and utilizing Alternate Files will be introduced.



Soft Tips

Soft Tips is a regular column aimed at providing software oriented hints and ideas for non-programmers. Members are encouraged to send in tips that can help a user better use his/her system. **Soft Tips** is designed to put forth ideas that are general in nature. The column is edited by Norman Vadnais, President of Computer Specialists & Associates, an Orange County Customer Support Specialist. Member's contributions can be sent to **Soft Tips** in care of I/O News. If you wish to discuss your software situation directly with Mr. Vadnais, he can be reached by phone at (714) 841-3620.

Keep Those Contributions Coming In
Thanks this issue to Morton C. M. Atkinson for his interesting letter regarding a variety of points. Mr. Atkinson is a research student in the Cryogenics department at Southampton University, England, where he looks after the Cromemco DPU-based system for his research group. We will discuss a couple of his general use command files and comments. Perhaps in future issues we can go into other aspects of his letter.

Our first command file is a simple one line script file to allow easy addition to your Cromix reminder file (the file named .reminder in your home directory). The name of the command file is rem.cmd and it is called by typing: rem [message of your choice]. The command file is:

```
(time; echo #*) .../reminder
```

The parenthesis combine the two commands into one, causing all output to be redirected with one command. The time and your message will be added to your reminder file and will now show up each time you log in.

The second command file mentioned by Mr. Atkinson is actually just a modification of the Cromemco command files provided to compile various languages. Often these command files allow for only one input file by using the variable -1 within the command file. There are two ways around this problem. The first is to enclose your multiple input files within quotes (CROMIX will think of this as one variable), and the second is to replace Cromemco's usage of -1 with the variable reference #* (which means all command arguments). Though the second choice is generally neater and easier to use, it could cause problems when more than one variable was originally requested in the command file.

A last point made by Mr. Atkinson is to remind us of two possible uses for the shell command. First he points out by calling shell before changing directories, you can return to your original directory with a simple exit. The following two command files are equivalent:

command sequence 1

```
% dir
/usr/norman
% shell
% dir /usr/letters
% [[ other commands ]]
% exit
```

command sequence 2

```
% dir
/usr/norman
% dir /usr/letters
% [[ other commands ]]
% dir /usr/norman
```

Both routines will change you to the /usr/letters directory and allow processing there. The first command sequence allows easy return to any directory, even if you do not remember where you started from!

The other use of shell is to force people to log in under lower priorities than CROMIX's standard priority of zero. By setting up a user's starting program as pri +5 shell, that user will operate on the system at a reduced priority. If the shell command was not at the end of the command line, the user would be logged off immediately!

Bugs Report

I do hope to be receiving more bug sheets from our various members over the next couple of months. We all hate bugs, wish they didn't happen, etc., but we also realize they do happen. Please help to make this column a forum for all bugs, in both new software and old, on C-10's, C/OS systems, Z80 CROMIX, and 68000 CROMIX alike.

A bug forum is important to Cromemco users for two reasons. First, it would be nice to have one place, easily accessible, to verify if your problem is the software's or yours (if you're the first to find it, this won't help you but will greatly help the ones behind you!). Secondly, we should be able, through reader response, to identify which of these little critters is most troublesome to the average user, and can press Cromemco to take care of these problems first. So don't gripe about that bug, WRITE about it instead!!!

Bug Collection # 1

1. Z80/68000 CROMIX — If you type ahead a large number of characters, do a line delete (control-U), and then retype more characters, the cursor can get lost as to the exact sequence of your inputs. What results is a messed up screen display with the cursor not necessarily back at the starting location. This is especially true if you are forced to do more than one line delete.

2. Z80/68000 CROMIX — Line deletes are being echoed (the proper number of characters are being erased) even though input is not being echoed to the

console, causing parts of the prompt to be eaten up.

3. Z80/68000 CROMIX, cmpasc utility — If two very similar files differ in the last few lines, the last line or two of the second file may not print for comparison to its counterpart in the first file.

4. 68000 Structured BASIC — A problem exists with FOR/NEXT loops. For example, a simple delay loop such as:

For X=TO 700: Next X

can cause the program to hang, with no way out short of a system reset. Richard Quinn determined that enabling the NOESC feature before the loop rectifies this problem (but prevents use of ON ESC branches out of the loop).

5. 68000 Structured BASIC — There appear to be some problems with the VAL function. A statement such as:

X=VAL(A\$(0,3))

can cause the system to hang. Also, VAL sometimes returns syntax errors on legitimate statements.

6. 68000 Structured BASIC — There is a subtle bug in the MAT initialization statement. Apparently, zeroing a matrix with MAT will "blank" out the first byte of the following statement. It looks like the loop controlling the initialization loops one time too many. A simple solution is to have a comment statement immediately following any matrix initialization using MAT.

7. 68000 Structured BASIC (and other 68000 programs that access the CROMIX Shell) — Executing a cntrl-c while at the shell prevents you from returning to the place from which you called the shell.

PLEASE, help me add to this list next time around!

CD

BACK ISSUES

of I/O News are available

NEW BASIC BOOK ✓ AND SOFTWARE ✓

You can get a new BASIC software package from Wayne Watson, the author of An Introduction to Structured BASIC for the C-10, published by Macmillan.

The book shows you how to use BASIC effectively, and includes chapters on files, debugging, procedures and much more.

The software package is contained on a single 5-inch disk, and includes a number of useful BASIC programs you can use immediately, including plotting and sorting. Emphasis is placed on C-10 graphics. Programs are completely described and listable.

Book: \$18. BASIC Software: \$45. Book + Software: \$57
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Alternate Solutions to LIBBUILD Size Problem

In John Willner's article, "Translation from MBASIC to 32K SBASIC" (Volume IV, No. 4), it was noted that libbuild.lis can be too large to load under SBASIC running under most versions of CDOS (there is no problem under CROMIX). Willner provided one solution: that of generating a smaller version of CDOS, using cdosgen, lacking function key coding and extra disk drives.

Dennis Matthews (IACU -882) offers two alternative methods. In one you can use screen to remove all REMark lines from the libbuild.lis source file. This will reduce the size of the program sufficiently to load it and save it (or execute). Alternately, you can generate a smaller version of SBASIC using basicgen.com, eliminating KSAM capabilities, user-defined functions, etc., (it does need to be interactive). This will also free enough memory to load and execute the library builder.

Some Useful Command Files

In response to last issue's announcement regarding public domain software for the IACU, Jon Griffin (IACU -3165), of Portland State University, contributed three handy command files. p.cmd will display the contents of the file phones. phones is a text file, created and maintained by whatever word pro-

cessor you use, which contains line entries of names and phone numbers — even addresses if you so desire. It should be present in the home directory of the user calling p.cmd. When called without arguments it displays the entire phones file. When followed with an argument, it displays each match of the argument. Jon noted that the faculty at the School of Engineering make constant use of p.cmd, and their ..phones files keep growing. Try it out and you'll see why.

```
%P.CMD
if '#1' = " goto all
%start match #1 ../phones
shift; if '#1' != " goto start
ECHO 'end of file' exit
%all
echo 'Syntax: phone [string]'
echo 'Contents of ../phones file:'; echo
ty ../phones
exit
```

last.cmd, when used without arguments will display the contents of the /etc/account file. When used with an argument, it will display only those records matching the argument. last = will display the times the system has been booted.

```
%last.cmd
if #1. = . goto all
who /etc/account | match #1
echo 'end of file'
exit
%all
who /etc/account
exit
```

users.cmd is similar to the other two, but displays the contents of /etc/passwd. When used with an argument it will match the argument, and is useful for determining if a particular user, or terminal is currently logged on. All three of these commands are intended to be in the /cmd directory.

```
%Users.cmd
if #1. = . goto all
match #1 /etc/passwd
echo 'end of file'
exit
%all
ty /etc/passwd
exit
```

SBASIC Gotcha!

Within the convoluted maze of conditions within conditions, that together constitute SBASIC.COM, lurks a voracious file-eating bug, recently discovered and classified by Bernie Thomas, our 32K Classroom editor.

Those that work with SBASIC are familiar with the dir command, which as the mnemonic implies, gives a directory listing of the files on the specified drive (or current directory under CROMIX). It also recognizes the use of "wildcards", such as *.sav which matches all files with an extension of sav. Thus, a statement such as dir ".*.LST" would give a directory listing of all files ending with .lst.

Whatever you do, don't confuse the use of the dir command and the list command! As you know, list is used to write an SBASIC program to the disk in ASCII format, or optionally, to generate a printer listing using the \$LP argument. What happens when you inadvertently issue the command list ".*.sav"? You would think that a syntax error would be generated. Such is not the case.

The innocuous looking command, list ".*.sav", opens the door for the bug which proceeds to erase all of the files ending in .sav. No error message, the files simply disappear. Bernie discovered this, fortunately, after having made a backup of the disk he was working on. Hopefully, mention of the problem here will save someone a lot of grief.

HD-50 Notes, OCTSEND errors, FDC & TUART modification

The following service notes were present on the Cromemco Eastern Regional Office BBS:

CROMIX

When partitioning a HD-50 for use with a CTD for backup, please use partition sizes less than 24Mbytes so that a complete partition will fit on one tape. If you choose to partition larger than 25Mbytes, make sure that you do a makfs -i 8220 on the drive. Because of memory limitations check -s will not work if the partition has more than 8220 inodes (files). Note that both initstdc and check -s should not be used if there is another user or task (such as flush) running.

STDC

The STDC must be the correct type (or modified) to match the processor type (XPU, DPU, or ZPU). Intermittent errors during initialization are usually due to a loose cable at the J1 connector. If the system hangs after interrupts are enabled, please check the priority cable again! Note that J5 is for STD0 and J4 is for STD32.

OCTSEND errors

If you are getting OCTSEND errors on the system console when trying to access a TTY line under UNIPLUS® System V, please examine the CROMIX /etc/startup.cmd and /etc/iostartup.cmd files. Verify:

1. That the OCTART is being properly loaded.
2. That there are NO references to /dev/qslpt-.
3. That there are NO references to /dev/mtty-.
4. If /dev/prt is referenced, that it is linked to /dev/qtty- and not to /dev/qslpt-.

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These packages are written in compiled code, and are available for CDOS, CROMIX (Z80), CP/M and PC/MS DOS machines. Write for details.



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FDC and TUART modification

Users running CROMIX with 16FDC's, 64FDC's, or TUARTs should read the following list of modifications. Implementing these modifications may help eliminate slow downs or 'Not connected' error messages.

CROMIX TTY and SLPT drivers have problems handling a line where the device is disconnected or turned off. CROMIX may slow down and or fail to recover when the device is reconnected. This is because the current loop circuit on FDCs and TUARTs causes the input to float to a space, generating a continuous stream of breaks, when it is not driven. The modifications outlined below disable the current loop circuit and should be performed for RS-232 applications.

16FDC: all revisions.

64FDC: up to Rev. B ML 9.

Remove one resistor:

'R23' 18K ohms colored 'Brown, Gray, Orange, Gold' located near IC31.

64FDC: Rev. B ML 10 and later.

No modifications necessary.

TUART: up to Rev. J3.

Remove two resistors:

'R7' 18K ohms colored 'Brown, Gray, Orange, Gold' located near IC20.

'R8' 18K ohms colored 'Brown, Gray, Orange, Gold' located near IC20.

TUART: Rev. K up to ML 2.

Remove two resistors:

'R9' 18K ohms colored 'Brown, Gray, Orange, Gold' located near IC20.

'R15' 18K ohms colored 'Brown, Gray, Orange, Gold' located near IC20.

TUART: Rev. K ML 3 and later.

No modifications necessary.

PACIFIC USERS' GROUP?

Ronald Kent, an employee of Eaton Corporation on contract to the U.S. Air Force at Hickam A.F.B., Hawaii, is interested in forming a local Cromemco users' group involving both military and civilian users. Their current equipment includes 72 CS-2H systems in use for processing of INTEL data and communications. If interested, Mr. Kent can be reached at the following address:

PACAF HQ / SICCS
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Attn: Ron Kent / S.S.F.



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System Performance

Continued from front cover

may help users to gain maximum performance from their present Cromemco systems.

The total number of simultaneous users a system will support with adequate performance is determined by several factors. These factors include memory upgrading, disk seek speed, use of RAM disks, disk software drivers, programming languages, applications software, use of command files, and spooling.

UPGRADING MEMORY

If users are unable to login or run programs because "all memory in use" or "process table full," productivity is hindered. This situation may be corrected in one of two ways: (1) If the Z-80 CROMIX is being used, the obvious improvement is upgrading to the 68000 CROMIX. In this case, an additional 256K of memory will probably be needed since the 68000 CROMIX requires more operating space. In addition to providing additional banks of user memory, this upgrade will also increase the process table size. (2) A second possibility for increasing process table space is simplifying the use of command (.cmd) files. Each time one .cmd file calls another an extra process table entry is made. Therefore, if process table space is a problem, it is best to avoid having one .cmd file call another whenever possible. Later versions of CROMIX and the CDOS simulator are better able to support a large number of users using CP/M software because the problem of "too many files open" is handled by the latest simulator. Also, a technically knowledgeable dealer can modify the systems software to increase the number of I/O channels. In addition, eliminating TU-ART devices can free up system buffers. Available ports on QUADARTS or OCTARTS can be used instead. This will also improve terminal I/O as well.

DISK SEEK SPEED

As the number of users and the amount of data on the hard disk increase, the disk seek speed becomes the most critical performance factor. Little difference is noticed between high and low seek speed drives when only a few megabytes of the disk are used. However, a careful comparison of two systems with disks about two-thirds full but with greatly different seek speeds showed that the system with the faster disk supported five users with better response than the slower one with only two users! The ratio of average seek speeds in the comparison was four to one (30ms. vs. 120ms). I classify disk speeds (using average seek time in milliseconds) as follows:

less than 30 ms—extremely fast

30-50 ms—fast

50-80 ms—medium

80-120 ms—slow

120 ms or more—very slow

Track-to-track seek time is insignifi-

cant if it is less than 10 ms. Rotation speed or latency is also of little importance. 4800 rpm vs. 3600 rpm gives faster program loading only if two consecutive blocks are on the same cylinder. Fast track-to-track seek and rotation speed can make a drive perform well when the drive is first used but will have little effect as the disk fills up. Therefore when comparing two drives, it is important to consider all factors.

RAM DISKS

Memory may be used as one or more disk drives with zero seek time. This method will not solve all problems associated with loading a large number of big programs, but will certainly help. In a system as sophisticated as CROMIX there is a significant amount of system overhead, but RAM serving as a disk is about twice the speed of the fastest disk drive. The flexibility in CROMIX and the latest CDOS simulator allows RAM to be very effectively used in this way.

The experience of a large CPA firm serves as an excellent example of the RAM's effectiveness as a disk. This firm installed one megabyte of memory to hold their tax programs. Six heavy users loading over 800K of tax program from memory rather than disk enjoyed a significant increase in productivity during the busy tax season.

DISK SOFTWARE DRIVERS

Software that controls the actual reading and writing to disk is usually provided by the disk subsystem manufacturer and cannot be modified by the dealer or user. However, a subsystem consisting of the same disk drive and controller but purchased from two different suppliers may show considerable differences in system performance as a result of the software drivers. Under the CROMIX operating system, each user's time slice is 100 milliseconds. The amount of data that can be read in one time slice is critical. During this time, slow drives can only make one seek but all can make several revolutions. Consequently, software that can read more than one block of data in one revolution can offer improved performance.

Ordinarily, during any disk operation no user gets any processor time. The use of interrupts can free the processor to work for another user during long seek times. Software that uses interrupts can reduce the amount of processor time required to control the disk to one-tenth the usual time without interrupts.

PROGRAMMING LANGUAGES

There is a wide range of performance levels for different languages and for different versions of the same language. The advantage of a language that gives five times the processing speed may be offset by the need to load programs that are five times as big. Sixteen bit versions are often much slower than 8-bit versions, even though they usually of-



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fer added features. A good example is the Microsoft "16-bit" BASIC on the IBM PC, which is slower than most 8-bit versions. Programmers should carefully experiment with their choices before making a commitment for any significant program development effort.

Also, consider that compilers are not always faster than interpreters, contrary to popular belief. For example, Cromemco Structured BASIC is twice as fast as the widely used C-BASIC compiler. Console or printer output of numbers and reading of numbers in test data files is many times faster with Cromemco BASIC than with Microsoft BASIC. Program development time not only uses the programmer's time but may also affect system response for others who share the same system. In most cases, programming and editing in BASIC take little system time, but the use of compilers for large files will really slow a system's performance.

APPLICATIONS SOFTWARE

Perhaps more applications software can be run on CROMIX systems than on any other system available today. Unfortunately, some of these packages give poor performance. However, several Cromemco dealers have customized packages that greatly improve their performance under CROMIX. One important example is Wordstar™, which in its unmodified form, runs very slowly.

Users who are writing their own applications can often improve performance considerably. For example, it is wise to avoid frequent opening and closing of files unless it is really needed. Under CP/M or CDOS, this precaution may have helped protect data in case of system failure; but under

CROMIX, it is a waste of time. Instead, it is more efficient to use the flush utility to insure that data gets written to disk intermittently.

The user can also save time by avoiding the popular bubble sort technique when sorting more than a few dozen items. The Shell sort is almost as easy to program and is many times faster for large numbers of items. A machine language sort may also be considered when a real increase in speed is needed.

Character I/O is also slow. Console polling (a program loop that continuously checks for the entry of a character) is sure to slow a system's performance. This is the main reason that unmodified programs like Wordstar run so poorly. In order to improve the performance of Structured BASIC programs (and also to simplify programming), we have added machine language routines to do formatted input, block output, and sorting. Procedures in Structured BASIC are very powerful features, but the frequent loading of the same procedure from your library on disk should be avoided. Instead, the lock command can lock frequently used procedures in memory.

COMMAND FILES

Some understanding of the way in which CROMIX works can result in programming for better system performance. When a command or program name is entered, CROMIX must search for the file. The search time can be shortened, often considerable, by using the full path name for the file. In the case of a .cmd file, this entry will eliminate the need to search the current directory and the /bin directory before getting to the /cmd directory. This is

most helpful inside the .cmd files themselves. Therefore, enter /cmd/ or /bin/ before the command name, as appropriate, and watch your system performance improve!

Assembly language programmers, if practical, modify programs to run faster under CROMIX without the need of the simulator. You will find that the CROMIX system calls are powerful and easy to use. The bin programs load and execute very rapidly.

SPOOLING

In a multi-user system, printer spooling is an absolute necessity unless the users are few and are located in the same room. Even then, productivity suffers when users must wait for a long print job to be completed before they run another program that may need the printer. The problem is that very few languages or application programs use spooling. Moreover, the usual method of handling the problem is not very satisfactory. This method involves first printing to a disk file, then exiting the program and using the spool.bin utility to spool the file to the printer. This method is awkward, inconvenient, and requires the spooler to make a second copy of the file. Copying the file takes both time and extra disk space.

At Systems Atlanta, we have solved the spooling problem in two ways. First, in Structured BASIC, we have added a spooler which allows the user to select the desired printer and also allows for direct output to the printer for those rare occasions when direct output is needed. Secondly, the use of CROMIX block I/O further improves overall performance. For all other CDOS and CP/M programs, we have written a small utility program which handles all the console and printer I/O, including spooling. These enhancements also allow a particular program to use more than one printer.

Years of experience as CROMIX users have allowed us to enhance our customer's systems to effectively support six active users when sharing one Z-80 processor (one additional Z-80 in the IOP is used, of course). The 68000 CROMIX supports even more users, but practically all applications are currently Z-80 based.

Sixteen and thirty-two bit systems give greater processing power but the size of the compilers and programs may offset some of this gain by increasing program load time. The large address space of the 68000 may make it possible for many applications to be combined in a single program. Reentrant code would make it unnecessary to load a program if a copy already exists somewhere in memory. The way in which 68000 software will affect system performance depends upon many factors and is difficult to determine without more experience. The old Z-80 may hold its own for some time, particularly for business applications.

With a little extra help, current Cromemco systems perform very well in almost all business applications, competing very well in performance with

multi-processor systems. Cromemco Z-80 systems with a fast disk drive even out-perform most 68000 based UNIX systems that I've seen.

Cromemco's three goals for the future are (1) "higher performance" (2) "higher performance" (3) "higher performance." We're ready Roger! * How will you do it? Faster disks of course, as attested by the recent STDC 50Mb. Reentrant code? Slave processors? Maybe even an 8086 slave to run MS-DOS software under CROMIX? "Real" networking? Regardless of the improvements Cromemco may make, users should remember that the way in which they use their systems may affect performance as much as anything else. Remember that efficient applications software is the other factor that Cromemco cannot control.

*Roger Melen, Cromemco Dealer Conference, December, 1983.

About the Author

Charley Dobson is President of Systems Atlanta, Inc., one of the oldest Cromemco dealers. With degrees in physics from Georgia Institute of Technology, his interests span the full range of the microcomputer world, from business applications to systems design. Having taught in the University Systems of Georgia for thirteen years, Charley now employs some of his best former students at Systems Atlanta.



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Beehive DM5A Crt (Cromemco Compatible)
Digital Research PL1, RMAC and LINK
Microsoft Basic— Assorted programs.

\$2,500 or Best Offer

Ernest Mangini
(609) 786-1138

System 400

Continued from front cover

minimum degradation of system performance.

High-performance Disk Control

The STDC is a high-performance disk controller that includes a dedicated microprocessor and a 4-track cache memory for high-speed operation (see *I/O News, Volume IV, No. 1*). It automatically verifies information written to the disk with a read-after-write cycle to assure data integrity.

I/O Control

The OCTART board is the serial I/O control for the System 400 and can be used for expanding the number of users or adding serial devices. The OCTART has its own processor and memory for minimum system overhead. Each OCTART has 8 serial channels, and up to 16 users can be accommodated by adding an additional OCTART board to a system.

Memory

The amount of memory in the System 400 varies, depending on the selected configuration. The CS-400 Series uses two high-density memory boards for supplying RAM: the 1024KZ board or the 2048MSU board.

The 1024KZ board is a 1-megabyte RAM board, without error-correcting capability. The 2048MSU board is a 2-megabyte RAM board, with error-correction, and is used in conjunction with Cromemco's MCU memory controller board.

In addition, Cromemco offers many other boards that can be plugged into the CS-400 to extend the capabilities of the system to meet your needs. These extended capabilities options are available to meet most applications and requirements:

- Communications
- Memory Expansion
- Multiple users
- Computation acceleration
- Networking
- Instrumentation and control
- Magnetic storage expansion
- Graphics

Extensive Software Support

The System 400 Series computers include the UNIX System V operating system. UNIX System V is the standard for the new generation of high-performance microcomputers. Included with UNIX are the highly-acclaimed Berkeley enhancements, including csh, termcap, uucp, and vi.

Cromemco also offers a full range of program development tools and supports programs written in all the popular computer languages, including C, Fortran 77, Basic, Pascal, Cobol, and ADA. In addition, several industry-leading applications programs, such as the Informix and UNIFY data base management systems, and the Q-office office automation software are available.

Versatile and powerful, UNIX pro-

vides the multi-user, multi-tasking features required by today's advanced applications and opens the door to a very large library of software for your system.

Advanced Packaging

The System 400 offers advanced design in the areas of cooling, power supply, and operator convenience. The front panel pilot light, for example, not only tells the operator that the system is on, but also that the air temperature in the box is at a safe level and that all power supplies are functional. Similarly, an array of diagnostic indicators inside the box allows an instant assessment of power supply status, even indicating when the AC power mains are unusually high or low (The CS-400 includes a line-voltage selection circuit which may be used to compensate for such variations).

The airflow scheme in the System 400 is bi-level; separate thermal environments are maintained for the cards and peripherals. This allows the sensitive magnetic-storage devices to operate without adverse effect from the heat produced by the logic boards. Twin thermal sensors feed information to a fan controller circuit which regulates the internal airflow.

A keylock on the power/reset switch ensures that a key operator can maintain control over the system; a second lock limits access to the card cage area. And to top it off, its all on wheels!

Continued

—Cromemco System 3—

★ ZPU, 64K, 16FDC, 299, 277, PRI, 4FDC, DBase II, Calcstar, 32K Basic, Accounting	\$2000
★ 3102 Terminal	\$500
★ NEC 7730 w/bi-directional tractor feed	\$1500
★ All of above	\$3500

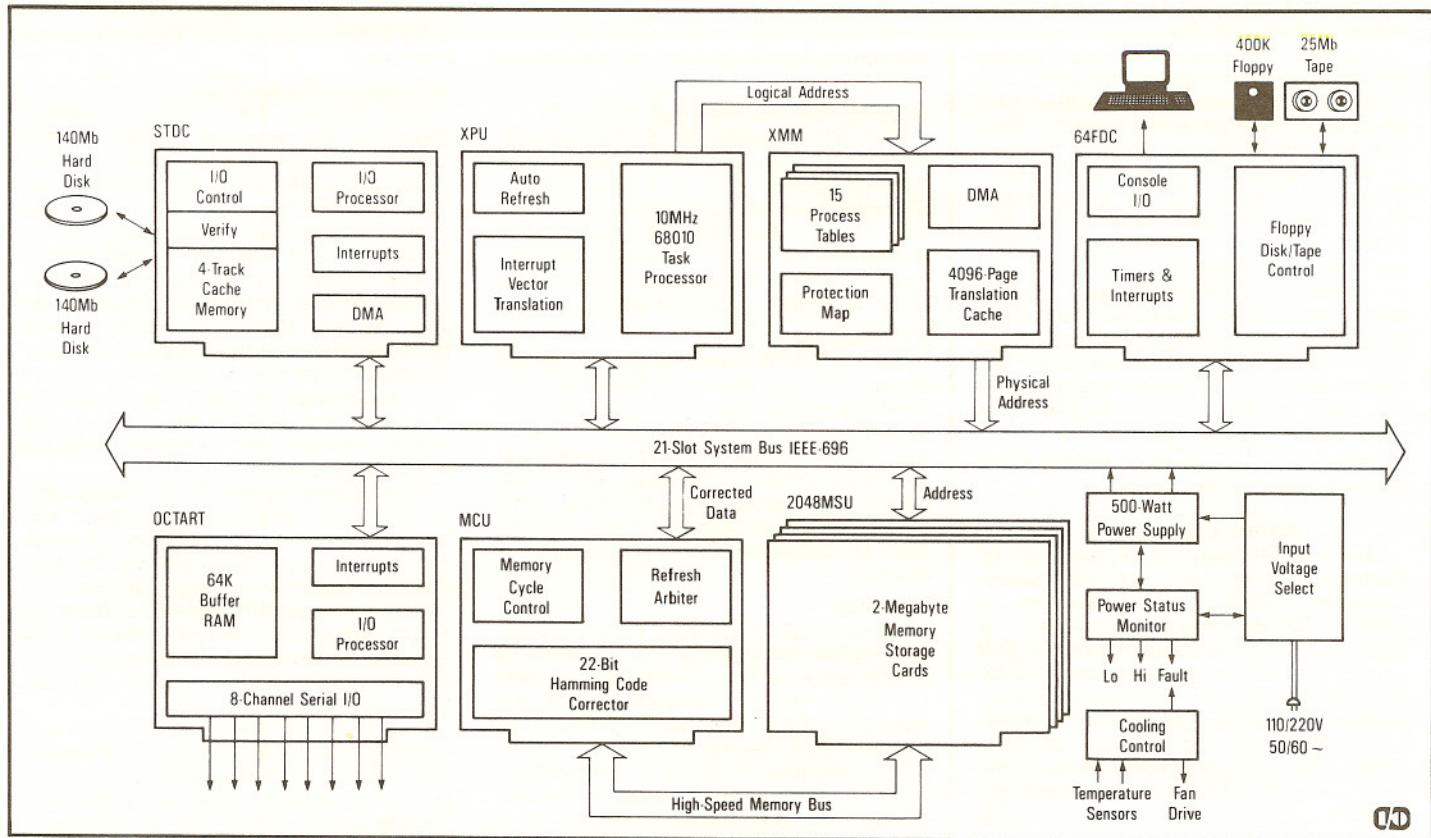
Brian Ziegler
312-741-8330

FOR SALE

Cromemco System 3. 348K RAM, W/Z80 & 68000 DPU (MOTOROLA). Two double sided 8" floppy drives. CDC Phoenix 80 mg fixed, 16 mg removable hard disk w/Konan driver board. 5 user ports, 3 printer ports. Cromix 11.11, Gunn Simulator. Wordstar w/Mailmerge, dBASE II, Calcstar. CDC always under maintenance contract.

Asking \$13500. Call (517)467-2051.

DIAGRAM OF CS-400 w/ERROR-CORRECTING RAM



Wordstar

Continued from front cover

take advantage of the powerful buffering and interrupt mechanisms of CROMIX. In addition, the mode of the

"Cromix"-ize

Your Wordstar & dBase

Tired of living with the CDOS Simulator, and what it does to Wordstar & dBase? Would you like to see your WORDSTAR run REALLY FAST? Could you find applications for fully utilizing CROMIX from within your dBase code? How about terminals and printers tailored to each individual use (either in WORDSTAR or dBase) with seven declarable directories (callable as drives A: through H:)? Then you'll have to call or write to:

T.S.E. Research & Development, Inc.
PO Box 2, Annapolis, MD 21404-0002
Phone 301/263-0958

"CROMEMCO SYSTEMS...THE RIGHT WAY"
Authorized Cromemco I.S.O. dealers
for "Cline" & "Proto-Matrix" products

(WORDSTAR, dBase, & CROMIX are registered trademarks, respectively, of Micro-Pro International, Ashton-Tate and Cromemco, Inc.)

FOR SALE:

Never Used Cromemco CS1H-5DE with C10SP-60.1 terminal, QUADART, 68000 Cromix CRO-DS, PRI, MT-1602 Mannesmann printer, and complete package software. Paid \$15,300, asking \$12,300 negotiable. Call Dr. Hall, Weddel, Stacey, 303-651-5143 daytime, or 303-772-1845 evenings.

user terminal must be set to -AB prior to executing Wordstar. Otherwise, the first control-c (advance page command) will abort the program in the middle of an edit.

The following program can be assembled and then "patched" into Micropro's Wordstar vers. 3.0 using Cromemco's debug. The patches will improve Wordstar performance under CROMIX, especially when the TU-ART board is used. Here's how it works:

1) The standard delays are shortened to 3,6,6,8 and 5 milliseconds, respectively.

2) Terminal mode is set to BINARY, so there is no need to set mode -AB prior to executing Wordstar.

3) Console input and status checks are performed via CROMIX Operating System calls. The CDOS simulator is bypassed.

4) Console output is sent directly to the ports if a TU-ART board is being used. Otherwise, output is performed via CROMIX Operating System calls. Again, the CDOS simulator is not used.

5) Only every 10th console status call will actually make a real status check. All the other calls return "no character pending." This eliminates the too-frequent status checking in Wordstar.

6) Printer output is sent to /dev/wsprt instead of /dev/prt. This gives the user the option of using a separate printer for Wordstar "letter-quality" correspondence.

Instructions for installing the patches are contained in the opening comments

of the program. However, the following points need still be made:

1) The file wsprt must be present in the /dev directory. Otherwise, an error message will be generated when using the print command. Simply make a link between /dev/wsprt and whatever printer is to be used. For instance, the command

maklink /dev/typ1 /dev/wsprt

will send all Wordstar printing to typ1. If only one printer is present on the system, the command

maklink /dev/prt /dev/wsprt

should be issued. Note that only one user may try to access the printer at any given time. Otherwise, results will be unpredictable.

2) The files wsolv1.ovr and wsmsgs.ovr should be present in the default directory for proper operation of Wordstar. The file ws.com should be installed in the /bin directory.

3) Printers requiring protocol are not supported.

About the Author

Bob Staudenmaier is the president and owner of Starplex Microsystems, a Cromemco dealership located in Rochester, New York. This is his second contribution, the first being "Another CROMIX SCREEN Editor", which appeared in I/O News Volume IV, No. 1. Members with questions regarding his ideas or techniques can contact him by phone at (714)436-8320, or by mail at: Starplex Microsystems, 955 Buffalo Road, Rochester, NY 14624.

```

;***** WSCRIMIX.Z80 *****
; This program contains patches to improve the performance of Wordstar
; vers. 3.0 under the Cromix Operating System. Maximum benefit is obtained
; when the Cromenco TU-ART board is used. This program should be assembled
; using Cromenco's Macro Assembler vers. 3.07 or greater. The files
; MODEQU.Z80 and JSYSEQU.Z80 should be linked into the default directory
; prior to assembling the program.
;
; 1) INSTALL Wordstar for your terminal. Select "Teletype-like Printer",
; "No Communications Protocol" and "User installed printer driver."
; 2) # ASMB WSCRIMIX.Z80 HEX
; 3) # DEBUG WS.COM
; 4) - F WSCRIMIX.HEX
; 5) - R
; 6) - F WS.COM
; 7) - W
; 8) - G 0
;
; PROGRAM AUTHOR: Bob Staudenmaier
; Starplex Microsystems
; 955 Buffalo Road
; Rochester, NY 14624
; (716) 436-8320
;***** WSCRIMIX.Z80 *****
*INCLUDE JSYSEQU.Z80
*INCLUDE MODEQU.Z80
;
; Most of the delays have to be shortened while running under Cromix.
;
ORG 2CFH
DELL1: DB 3 ;short delay
DELL2: DB 6 ;medium-short delay
DELL3: DB 6 ;medium delay
DELL4: DB 8 ;long delay
DELL5: DB 5 ;screen refresh delay
;
; Pointers to the user installed I/O routines.
;
ORG 2A4H
INISUB: JP INIT ;jump to user installed terminal initialization
ORG 2BAH
UCNSTA: JP CCR ;jump to user console character ready routine
UCCNI: JP CCI ;jump to user console character input routine
UCCNO: JP CCO ;jump to user console character output routine
ORG 70DH
PRINT: JP PSETUP ;jump to user supplied printer initializer
PRFINI: JP PCLOSE ;jump to user supplied printer de-initializer
ORG 74FH
PUSEND: JP CPRINT ;jump to user supplied character print routine
;
; Modify pointer to beginning of Wordstar working storage.
;
ORG 35CH
PBNMEN: DW FINI ;point to beginning of Wordstar working storage
;
; USER INSTALLED ROUTINES BEGIN HERE
;***** WSCRIMIX.Z80 *****
ORG 7849H
;
; User installed terminal initialization routine.
; First, set the terminal mode to binary.
;
PORT: DB 0FFH ;default port for console output
INIT: LD B,STDIN ;number of standard input channel
LD C,MD_MODE3 ;mode to change
LD E,"binary ;mask for characteristics to change
LD D,"binary ;same
JSYS .SETMODE
;
; Now determine whether or not the console is being driven off of a TU-ART.
;
LD B,STDOOUT ;want to get status of standard output device
LD C,ST_DEVNO ;want device number
JSYS .CSTAT
LD A,1 ;does console have major device number 1?????
CP D
RET NZ ;if not, return to Wordstar
LD A,E ;put minor device number into accumulator
RLC A ;now multiply by 16 to get the right port
RLC A
RLC A
LD (PORT),A ;now store proper port for CCO routine
;
; Also, reduce the number of "dummy" CCR calls to five.
;
LD A,5
LD (RESTOR),A
RET
;
; User installed console character output routine. This routine will perform
; hardware dependent output to a TU-ART board. If the console is attached to
; some other kind of device, a call is made to the Cromix Operating System.
;
CCO: LD BC,(PORT) ;fetch two bytes telling which port
INC C
JP NZ,HOUT ;jump to hardware dependent routine if O.K.
LD B,STDOOUT ;otherwise, let Cromix do it
JSYS .WRBYTE
RET
;
;***** WSCRIMIX.Z80 *****
HOUT: DEC C ;put C back the way it was
LOOP: IN (C) ;check status
JP P,LOOP ;if not, try again
INC C ;want to write to next port
OUT (C),A ;now write the character
RET
;
; User installed console character ready routine.
;
; This routine returns ACC=FF if a character is pending at the console.
; Otherwise, ACC=0 is returned. Since Cromix stores all typed characters
; in an input buffer, it is not necessary to make this call nearly so often
; under Cromix as under CP/M. Therefore, unless a TU-ART board is used, only
; every 10th call to CCR will actually make a real console status check. For
; all the others, ACC is set to zero and program control returns to main.
;
;***** WSCRIMIX.Z80 *****
TIMES: EQU 10
RESTOR: DB TIMES
COUNT: DB TIMES
CCR: LD A,(COUNT) ;fetch number of times since last call
DEC A
JP Z,OK ;OK if 25th call since the last time
LD (COUNT),A ;load COUNT with COUNT-1
LD A,0 ;no character ready yet
RET
;
OK: LD A,(RESTOR) ;restore COUNT to 25
LD B,STDIN ;standard input channel
LD C,HD_STATUS ;want to check status node
JSYS .GETCODE
LD A,D ;set returned byte up for comparison
AND Z,EMPTY ;check to see if proper bit is set
JP A,EMPTY ;buffer has character, return proper value
LD A,0FFH
RET
;
; User installed console character input routine
;
;***** WSCRIMIX.Z80 *****
CCI: LD B,STDIN ;standard input channel
JSYS .RDBYTE ;now read the character
AND 0111111B ;kill the high order bit
RET
;
; Subroutine to initialize the printer.
;
PCHAN: DS 1 ;place to put the I/O channel number
OWIDTH: DS 1 ;place to store old page width
OBM: DS 1 ;place to store old bottom margin
NAME: DB '/dev/wsprt',0 ;device name of system printer
;
PSETUP: LD C,OP.WRITE ;open for non-exclusive write
LD H,NAME ;H,NAME
JSYS .OPEN ;NC,OPENOK ;jump to OPENOK if printer free
JP ERROR
;
OPENOK: LD A,B ;store the channel number for future use
LD (PCHAN),A
LD C,HD_BMARGIN ;set the bottom margin to zero
LD D,0
JSYS .SETMODE
LD A,D ;store the old bottom margin for future use
LD (OBM),A
RET
;
; Subroutine to de-initialize printer.
;
PCLOSE: LD A,(PCHAN) ;fetch the channel number of the printer
LD B,A
LD A,(OBM) ;restore the old bottom margin value
LD D,A
LD C,HD_BMARGIN
JSYS .SETMODE
JSYS .CLOSE ;now close the channel
RET
;
; User supplied print character routine.
;
CPRINT: LD BC,(PCHAN-1) ;fetch channel number of the printer
JSYS .WRBYTE
RET
;
; Error routine for printer busy
;
ERROR: LD B,STDERR ;channel number of standard error
JSYS .ERROR
;
FINI: EQU $ ;exit
END
;
;***** WSCRIMIX.Z80 *****

```

Current Versions of Cromemco Software

This table lists the current versions of all Cromemco software. It was derived from Cromemco's Software Product Version Report of June 10, 1985. The following notations are used: 'NA' implies that the information is not applicable or was not supplied in the product version report. An '*' after the model or release number indicates a preliminary release. Models which have a "-D" indicate 68000 software; those with a "-X" indicate UNIX software. Almost all software is supplied on both 8 inch and 5 inch diskettes, so the 'L' (for large) and 'S' (for small) have been omitted from the model numbers. Also, almost all software is supplied on Double Sided, Double Density diskettes. Much of the UNIX software is supplied on tape archive.

CD

MODEL	PACKAGE	RELEASE	VERSION	CREATED
3270BSC-D	IBM 3274/51C BSC EMULATOR	1	03.05	02/21/85
ANI-D	ANIMATOR (COBOL-D DEBUGGER)	1	NA	10/24/83
ANI-X	ANIMATOR (COBOL-X DEBUGGER)	1	NA	04/25/85
ASM-D	68000 MACRO ASSEMBLER (CROMIX)	2	01.14	02/16/83
BAS-D	68000 BASIC	1	02.10	11/07/83
BAS-X	UNIX 68000 BASIC	1	02.20	09/27/84
BNET-X	UNIX NETWORKING S/W	1	NA	04/29/85
C10CPM	C-10 CP/M OPERATING SYSTEM	1	02.00	01/17/84
CAMR	CALCMASTER	4	NA	02/29/84
CCC	CROMEMCO 'C' COMPILER	2	05.10	01/04/83
CCC-D	68000 'C' COMPILER	3	02.15	05/17/84
CCC-X	UNIX 'C' COMPILER	1	02.20	09/17/84
CDS	CROMEMCO DIAGNOSTIC SOFTWARE	4	NA	07/15/83
CISAM-D	C-ISAM	2	2.03	12/19/84
CISAM-X	C-ISAM FOR UNIX	1	2.03	10/15/84
COB-D	68000 COBOL COMPILER	2	NA	11/04/83
COBRT-D	RUN TIME COBOL	1	NA	05/02/85
COBRT-X	UNIX RUN TIME COBOL	1	NA	05/21/85
COB-X	UNIX COBOL COMPILER	2	NA	11/04/83
COLL	CROMEMCO OVERLAY LINKER	3	02.04	03/25/83
CRO-D	68000 CROMIX OPERATING SYSTEM	8	20.65	03/27/85
CROMIX	Z-80 CROMIX OPERATING SYSTEM	11	11.27	07/03/84
CRO-PLUS	CROMIX PLUS FOR XC SERIES	2	30.79	04/18/85
CSPD	C-10 SUPER PACK	6	NA	07/25/84
CTDS-S	68000 TAPE DRIVER SOFTWARE	2	NA	11/14/84
CXDR	CROMIX DRIVER PACKAGE	1	NA	05/18/83
DIMR	DISKMASTER	2	01.11	09/08/84
DOS	CDOS OPERATING SYSTEM	12	02.58	11/07/83
FDA	Z-80 MACRO RELOCATING ASSEMBLER	12	03.10	07/18/83
FDB	Z-80 BASIC	11	05.70	03/29/83
FDC	Z-80 COBOL COMPILER	6	04.64	03/29/83
FDF	Z-80 FORTRAN COMPILER	11	03.42	03/30/83
FDR	Z-80 FORTRAN WITH RATFOR	4	01.05	03/29/83
FM2-D	FORMS-2 (COBOL-D FORM GENERATOR)	1	NA	10/24/83
FM2-X	FORMS-2 (COBOL-X FORM GENERATOR)	1	NA	04/25/85
FOMR	FONTMASTER	5	01.16	08/19/83
FOR-D	68000 FORTRAN COMPILER	6	02.15	05/17/83
FOR-X	UNIX FORTRAN COMPILER	1	02.20	09/17/84
FSTBAS-D	68000 FAST BASIC	1	02.10	03/23/84
FSTCCC-D	68000 FAST 'C' COMPILER	2	02.15	07/05/84
FSTFOR-D	68000 FAST FORTRAN COMPILER	3	02.15	10/16/84
FSTPAS-D	68000 FAST PASCAL COMPILER	3	02.15	10/16/84
IDS	IOP DEVELOPMENT SOFTWARE	6	03.00	07/25/83
INFX-D	INFORMIX (68000 RELATIONAL DBMS)	2	03.20	11/19/84
INFX-X	INFORMIX FOR UNIX SYSTEMS	1	03.20	09/19/84
KSAM	KSAM FILE ACCESS SYSTEM (CROMIX)	3	01.04	03/01/83
LEX	UNIX WORDPROCESSING PACKAGE	1	NA	10/10/84
LSP	LISP	5	01.08	03/31/83
MAXASM-D	MAXIMIZER MICROCODE ASSEMBLER	1	02.08	11/06/84
NCG-X		1	NA	04/25/85
NET	C-NET NETWORK SOFTWARE	2	NA	03/20/84
PAS-D	68000 PASCAL COMPILER	5	02.15	05/17/84
PAS-X	UNIX PASCAL COMPILER	1	02.20	09/17/84
RBTE	REMOTE BATCH TERMINAL EMULATOR	5	01.08	11/17/83
RMCOB-X	UNIX COBOL COMPILER	1	NA	10/31/84
RPG	Z-80 RPG II COMPILER	4	03.02	03/31/83
SDDDEMO	SDD DEMONSTRATION SOFTWARE	1	NA	01/26/84
SDIDEMO	SDI DEMONSTRATION SOFTWARE	5	NA	04/04/83
SGS	SDI GRAPHICS SOFTWARE	6	02.00	09/06/83
SLMR	SLIDEMASTER GRAPHICS EDITOR	4	02.03	04/26/83
SMCBAS-X	UNIX STRUCTURED BASIC	1	NA	11/06/84
SMDS	SMD DRIVE CONTROLLER SOFTWARE	2	NA	07/06/84
SPICE-D	SPICE CIRCUIT DESIGN SOFTWARE	1	11.02	06/21/84
SPMR	SPELLMASTER SPELL PROOFING	5	01.20	06/27/83
STB	32K STRUCTURED BASIC	11	03.65	03/31/83
STB-D	68000 STRUCTURED BASIC	1	1.00	09/24/84
STMR	STATMASTER STATISTICAL PROGRAMS	2	01.04	07/21/83
TDS	TAPE DRIVE SOFTWARE	4	11.11	04/01/83
TEMR	TELEMASTER COMMUNICATION SOFTWARE	2	02.06	04/24/84
TSDI	TRI-SDI GRAPHICS SOFTWARE	3	NA	04/01/83
TSS	TRACE SIMULATOR	NA	02.06	03/06/80
UDST-X	UNIX DOCUMENTATION SOFTWARE TOOLS	2	NA	02/07/85
UFY-X	UNIFY (UNIX RELATIONAL DBMS)	1	NA	11/01/84
ULTCALC-X	ULTRACALC SPREADSHEET (UNIX)	1	NA	12/15/84
UNIX-X	UNIX OPERATING SYSTEM	2.1	NA	04/15/85
UPST-X	UNIX PROGRAMMERS SOFTWARE TOOLS	2	NA	02/06/85
WPS	WORD PROCESSING SYSTEM	11	06.00	04/01/84
WRMR	WRITEMASTER WORDPROCESSING SYSTEM	10	02.02	11/01/84

Local Cromemco User's Groups

Arizona Association of Cromemco Users

Contact: Jo Ann Drake, President
2207 West Eugie Avenue
Phoenix, AZ 85029
(602) 993-9589

Australia User's Group*

Contact: Minicomp
Minicomp Building
104 Mount Street
North Sydney, NSW 2060
Australia
(02) 957-6800
Meets monthly
*Publishes "Minicomp/Cromemco" a
monthly newsletter

Bay Area Cromemco Users & Programmers (BACUP)

Contact: Raymond Barglow or Alan Walworth
United Word & Data Processing
2345 Fulton Street
Berkeley, CA 94704
(415) 841-0708 or (415) 548-2692

Cromemcohorts

Contact: Dr. Brent Lowensohn
4747 Sunset Blvd.
Los Angeles, CA 90027
(213) 667-8972

Cromemco Users' Group of Australia*

Contact: Tony Stringer
52 Beechwood Avenue
Greystanes, 2145
*Publishes a magazine "CROME-SOMA"

Cromemco Users' Group Holland (CUGH)

Contact: Joop Kohler, Secretary
P.O. Box 120
2910 AC Nieuwerkerk a/d IJssel
The Netherlands 01803 - 3300

Cromemco Users' Group

Contact: Peter Norman
The University of Newcastle Upon Tyne
Department of Chemical Engineering
Merz Court, Claremont Road
Newcastle Upon Tyne NE1 7RU
England
Newcastle 28511, Ext. 3278
*Publishes Cromemco Users' Newsletter
(CUG)

Cromemco Users' Group Ontario, Canada

Contact: Lloyd Parker
Hiram Walker Resources Ltd.
Suite 600
1 First Canadian Place
Toronto, Ontario
Canada M5X 1A9
(416) 864-3349

Cromemco Users of Orange County, California

Contact: Michael Peterson
Accountability Systems
700 South Tustin Avenue
Suite B
Orange, CA 92667
(714) 639-4570
Meets third Tuesday Monthly

Insystems Pty. Ltd.*

Contact: Norman Rosenbaum
337 Moray Street
South Melbourne, Victoria
3205 Australia
(03) 690-2899, telex AA30458
*Publishes "Cromemco UPDATE"
a bi-monthly newsletter

Illinois Users' Group

Contact: Jim Knowles
P.O. Box 631
Elgin, IL 60120
(312) 695-7775

Indonesian Cromemco Users' Group (ICUG)*

Contact: Zafir M.A. Pontoh
Computation Lab
Department of Regional & City Planning
Bandung Institute of Technology
10 Ganesh
Bandung, Indonesia
(022) 82051 ext. 360
*Publishes "BERKALA ICUG,"
a monthly newsletter

Microcomputer Users' Group

Contact: Noble Bright
P.O. Box 1
Cape May, NJ 08204
(609) 884-2222
(609) 429-3838
Meets fourth Wednesday monthly

Northwest Association of Cromemco Users (NWACU)

Contact: Jim Illman
403 S. Brandon
Seattle, WA 98108
(206) 763-2099

North San Diego County Users' Group

Contact: Charles Mackey
P.O. Box 397
Fallbrook, CA 92028
(619) 728-6116
Located 30 mi. east of Oceanside

North Texas Cromemco Commercial Users' Group

Contact: Jerrell Johnson
1131 Winterwood
Lewisville, TX 75067
(214) 221-1437
Or call Rocky Hall
@ (214) 398-1595
Meets first Wednesday bi-monthly

NY, NY Users' Group

Contact: Charles Perrella
45F Route 303
Valley Cottage, NY 10989
(914) 268-5137

SaCromemco Users

Contact: Alan Whitman
Box 244
Rancho Cordova, CA 95670
(916) 635-6070

Silicon Valley Cromemco Users

Contact: Alan O'Neill
(415) 969-3854 or Emily Ott (415)
854-5818
Meeting place provided by:
MCM Enterprises
215 Hamilton Avenue
Palo Alto, CA 94301
Meets Fourth Tuesday monthly

W.A. Cromemco Users' Group

Contact: Rae Canning
c/o The W.A. School of Computing
2/294, Rokey Road
Subiaco, Western Australia 6008

West Germany Users' Group

Contact: Glynnis Long
Tesco GmbH
P.O. Box 10
8714 Weisenheid
West Germany
09383-1237
Total fluency in English & German

Wisconsin Cromemco Users' Group

Contact: Bob Ungemach
6249 West Browndeer Road
Browndeer, WI 53223
(414) 355-1451

Commercial Member Listing

Special Memberships are open to authorized Dealers and OEMs only. These memberships cost \$350 per year, and entitle the member to a special listing on the Association's Referral Service Data Base, as well as this printed listing.

North America

Western United States

ACCOUNTABILITY SYSTEMS

700 South Tustin Avenue, Suite B
Orange, CA 92667
(714) 639-4570

An exclusive Cromemco dealership, Accountability Systems caters to the growing business and industrial base in Southern California. The Orange office supports the new personal computer system. Classroom training is available at both locations. CROMIX and Communication specialists. Developers of a professional medical billing package that can be used in single or multi-medical-offices. The package provides full accounting for the medical office including monthly Patient Statements, Medicare & Medical Forms and Standard Insurance. Complete Business Accounting software that is customizable.

Orange Office:
Key Personnel: Michael L. Peterson, Systems Analyst
Kathleen Peterson, Office Manager
Pat McGuire, Jr., Software Systems
Bruce Hughes, CPA, Acctg. Consultant

EXCALIBUR COMPUTERS

4558 Auburn Blvd., Suite 191
Sacramento, CA 95841
(916) 972-9252

Complete Systems house providing Sales, Service, Warranty Repair and Support for Cromemco Products. Custom Software developed in-house. Training available for CDOS, Cromix and Languages, as well as hardware. Has developed a Medical Billing Package and an Attorney Billing Package written in 32K Structured Basic. Market Cromix Drivers to implement concurrency on various different terminals.

Key Personnel: Robert Brown, Sales and Marketing
Curt Johnson, Systems Engineer
Jon Aimone, Software Support
Charles Stevenson, Design Engineer
Daniel Brown, Customer Support

Major Market Area: Sacramento, extending into Northern California

MCM enterprises

215 Hamilton Avenue
Palo Alto, CA 94301
(415) 327-8080

Sales, Service, Integration, Installation, and Innovation—these are key words to describe MCM Enterprises. MCM is a full service computer solutions company with consulting, equipment, software, training, and service. MCM carries a full line of Cromemco Systems, NEC, Diablo, Epson & Okidata Printers, Realworld Accounting, Peachtree, Micropro (the WordStar People), ProCall Communications Software, and other specialized software. MCM people are UNIX specialists with EMACS, Apgen, Q-office and other unique UNIX packages. MCM Enterprises also offers full service on NEC Spinwriters, PerSci floppy drives, and all Cromemco equipment. MCM offers a variety of equipment and program service agreements. MCM also custom configures systems for international power requirements and has full export services. Call for training on CDOS, Cromix, UNIX and languages, as well as hardware.

Key Personnel: M.C. Merchant (MSEE), President
Ken Brown, Sales
Lee Terry, Sales
Richard Walker, Dealer Sales
Dana Darcey, College and University Sales
Ronn Blaylock, Service Manager
M. Nadaire, (MSEE), Manager Paris Office

Major Market Area:

Sales: San Francisco Peninsula & Nevada extending internationally.

Service: S.F. Peninsula and Nevada extending into N. California.

Paris Office: 4 Rue Paul Bert
92150 Suresnes, France
Tel (1) 506 33 03

TLX 610994F

MULTI-MEDIA VIDEO INC.

3350 Scott Blvd., Bldg. 21
Santa Clara, Ca. 95051
Tel: (408) 727-1733
Tlx: 171-577 MMV USA

Multi-Media Video, (MMV), markets bilingual Arabic/English Cromemco systems and peripherals throughout the Middle East. Installations have been made in the government and banking sectors; a complete Arabic banking system was developed for the latter.

Key Personnel: A.B. Kader, President
Miguel Mora, Sales Manager
Jill Peterson, Marketing Manager

Major Market Area: Authorized dealers in Egypt, Saudi Arabia, and Pakistan.

Mid United States

ASGARD COMPUTING EQUIPMENT, INC.

121 West 6th Street
Neillsville, WI 54456
(715) 743-3344
823 5th Street
Menominee, MI 49858
(906) 863-6733

Exclusive Cromemco dealer with long term Cromemco association. Office includes on staff Engineers, Accountants & Chemists.

Key Personnel: James L. Bailey, President
Jerry Hagen, Vice President/P.E.
Ed Baetke, Secretary/Treasurer/Chemist

Major Marketing Area: Upper peninsula in MI, Northern & Western WI, Eastern MI.

COMPUTER CROSSROADS OF AMERICA, INC.

6 Terrace Shopping Center
Richardson, Texas 75081
(214) 231-6108 Twx/Telex 4991118

We are a CROMEMCO MASTER DEALER engaged in DEALER and OEM sales, service and support. We are in the top twenty-five dealers in the U.S. We have a consulting staff comprised of specialists in hardware, software and applications engineering. We are presently engaged in sales from the hardware level (equipment and/or software delivered in an unopened box) through the complete systems level where we take full responsibility for the system hardware configuration, instruction and maintenance of a system. As our name implies THIS IS THE CROSSROADS WHERE IT ALL COMES TOGETHER.

Key Personnel: Ed Fearon, Sales & Support
Danney Jarman, Sales & Support
Joe Essler, Sales & Support
Bill Carnahan, Support

Major Market Area: Sales & Service Worldwide

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Box 96, West Highway 54
Liberia, KS 67901
(316) 624-8111, IN KS 1-800-362-9000
Outside KS 1-800-835-2057

Exclusive Cromemco dealer, specializing in complete business systems. Provides consulting services. Full inventory.

Key Personnel: David Fuller, Store Manager

Ray Cole, System Development

Kevin Elmore, System Development

Clark D. Stewart, President

Wayne Stewart, Vice President

Major Market Area: Sales: S.W. Kansas, extending to Colorado, Kansas, Oklahoma, Texas, New Mexico. Service: S.W. Kansas

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35 Fountain Square Plaza, Suite 207

Elgin, IL 60120

(312) 695-7775

Full inventory of Cromemco hardware and software. Custom software developed in-house. Vertical market packages available include: Chiropractic Clinics; Architectural Woodwork Job Costing; Social Service Agency Accounting; Auctioneering. Specializing in providing turnkey systems to small and medium sized businesses.

Key Personnel: Jim Knowles, Pres. (Sales)

Major Market Area: Sales: Chicago and suburbs, extending to entire U.S. and the U.K. Service: Chicago and suburbs.

Eastern United States

CCS, INC.

A Computer Services Company

733 Third Avenue

New York, NY 10017

(212) 986-7520

Large Cromemco OEM specializing in custom applications on Cromemco Hardware. Full range of services including hardware sales, rentals, long and short term leasing, custom programming and continuous hardware and software support. Specialists in database and large scale financial applications.

Key Personnel: Richard Levey, Vice President

John Ruffo, Vice President

Major Market Area: U.S. and Major cities throughout the world.

TREXIS (Formerly Computer Closet Inc.)

45F Route 303

Valley Cottage, NY 10989

(914) 268-5161

Complete systems house providing sales, service and support for the full line of Cromemco hardware and software. Provides system planning and design for custom applications in business, education, and professional fields. Regular schedule of seminars and training classes offered.

Key Personnel: Rick Townsend, President

Major Market Area: Sales: Northeast U.S. and East Coast Service: Continental U.S.

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300 Vanderbilt Motor Parkway

Hauppauge, NY 11788

(516) 231-1155

Full service systems house with retail showroom. Full line of Cromemco hardware, software, accessories, and literature. Provides warranty service, diagnostics, consultation, systems analysis, and custom programming. Special management software for attorneys, mass transportation scheduling, reservations, delivery manifests, education, small business.

Key Personnel: Gregory G. Galdi, President

Linda M. Miller, General Manager

Major Market Area: Sales: Northeast U.S., extending to East Coast.

Service: East Coast extending to Continental U.S.

SYSTEMS ATLANTA, INC.

P.O. Box 99

Highway 5, Toonigh Road

Lebanon, Georgia 30146

(404) 928-0240

As one of Cromemco's oldest dealers, Systems Atlanta is well experienced in hardware and software implementation. With over 1000 systems installed and a full staff of highly seasoned employees, Systems Atlanta of-

fers technical support for operating systems, application software and hardware design. Specific configurations include telecommunications, graphics, data base management as well as fully integrated accounting systems. Systems Atlanta has authored several specific applications packages such as Manufacturing and Inventory Control, Church Management, Job Costing and Unix based programs.

Key Personnel: Charley Dobson, President & G.M.

Betty Dobson, Dir. of Finance & Admin.

Gary Kendrick, Dir. of Marketing

Steve Garrison, Operations Manager

Major Market Area: Worldwide, with exports to South America, Europe, the Middle East and Canada.

Canada

COMPUTER SOLUTIONS

1700 Varsity Estates Drive N.W.

Calgary, Alberta

Canada T3B 2W9

(403) 286-8459 Telex: 03-827506

Complete sales, service and support center for Cromemco and a variety of quality peripherals and support products. Specializing in support over long distances, OEM accounts, custom software, solutions to computing concerns.

Key Personnel: Bob Pyle, General Manager

Mark Dutchuk, Customer Support

John Shepherd, Sales Manager

Primary Marketing Area: Western Canada

Extended Marketing Area: Eastern Canada, Northern/ North-Western U.S.

D.E. SYSTEMS LTD.

1284 Wellington St.

Ottawa, Ontario

Canada, K1Y 3A9

(613) 729-5164

D.E. Systems Ltd. is a full service company offering Cromemco Hardware, Software Development, Education and Application Programs. We have developed integrated Inventory, Point-of-Sale, Invoicing, Accounting and Sales Analysis programs as well as a Courier Package. We specialize in Cromemco Computers for government and small businesses. We have most Cromemco products in stock and offer technical support on the hardware and software. We offer maintenance of all Cromemco equipment and related peripherals.

Key Personnel: Bruno Dugas, President

Keith Corkum, Director (Systems Development)

Dwight Presley, Senior Analyst

Major Market Area: Eastern Canada

Mexico

SOPORTE ADMINISTRATIVO COMPUTACIONAL, S.A.

15 de Mayo 1111 Pte.

Monterrey, N.L., Mexico

Tels. (83) 43-83-40 and 44-62-69

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Key Personnel: Juan Angel Perez, Director

Luis Ernesto Rodriguez G., Marketing

Delfino Juarez, MSEE Technical Support

Major Market Area: Northeast Mexico

International

Europe

Middle East

MICRO COMPUTER SYSTEMS MARKETING CENTER

P.O. Box 1446

Jeddah, Saudi Arabia

(966) (2) 651-7707 or 653-0580/Telex 928-403068 MICSYS SJ

Authorized Dealer in Jeddah-Saudi Arabia (Western Zone) for Cromemco sales and maintenance of computers, peripherals, software development and design. Strong Arabic Software development.

Key Personnel: Abdul Rahman H. Attar, General Manager
Issam Al Safadi, Administrative Manager
M. Ali Khan, Marketing Executive

REALTIME ENGINEERING & DATA ANALYSTS

P.O. Box 278
Dhahran Int'l Airport
Dhahran, Saudi Arabia
(966) (3) 8649043/Telex: 928-670480 READAK SJ
P.O. Box 6156
Jeddah
Saudi Arabia
(966) (2) 6531502

Sales and maintenance of computers, peripherals and supplies within the areas of automation, industrial, business and office. Security systems. Strong in developing ARABIC SYSTEMS (hardware and software) and turnkey projects. Large simulators and facsimile.

Key Personnel: A.A. Salamah, Administrative Director
Nasir Jamil, Manager Digital Systems Div.
Ziyad Ismail, Software Design and Development

Major Market Area: CROMEMCO distributor for Middle East (Saudi Arabia, Gulf Emirates, Iraq, Syria, Jordan, Lebanon)

Far East

ASAHI GLASS
Electronics Group
Special Products Marketing Div.
1-2 Marunouchi, 2 Chome
Chiyodaku, Tokyo 100
Japan

781-24616/Telex: 24616 ASAGLAS

Complete line of Cromemco hardware and software in inventory. 700 sq. foot training room. Specializing in O.S. modifications. Full service facility, providing technical consulting as well as warranty repair service.

Key Personnel: Shigeo Satoh, General Manager (systems)
Norimasa Hori, Manager (sales)
Shinichi Watanabe, Tech/software

Major Market Area: Japan

NCC INTERNATIONAL
Matsunaga Bldg. 1-6-6 Sotokanda Chiyodaku Tokyo 101
Japan 03-(255)7991 / Telex: 781-2523758 KKSHIP J

The oldest microcomputer store of the Byte Inc. Group, offering CROMEMCO to Japan since 1977. This company primarily sells CROMEMCO equipment, and provides high technology and comfortable customer service.

Key Personnel: Kiyotake Ikeda
Ryuichi Kawase

SUPER-NATURE COMPUTER CO., LTD.
4F-1, No. 239, Ta-An Road, Sec. 1
Taipei, Taiwan, Republic of China.
(02) 705-2442, (02) 700-4858/TELEX: 13937 SNCOMPUT

Our Company primarily sells CROMEMCO computer equipment with high technology and experience, providing installation, warranty repair service and customer education.

Specializing in O.S. modifications, software and hardware development for business and industrial applications.

Key Personnel: Miss Su-Chin Kuo, President
Mr. Mark Yeh, Sales manager
Mr. Morgan Chen, Import/Export department
Mr. Ringol Shiung, Chief of R&D department

Australia

MINICOMP
Minicomp Building
104 Mount St.,
North Sydney, NSW. 2060
Australia
(02) 957-6800
AA75774 MINICO

Key Personnel: Mr. Murray Cleworth, Managing Director
Ms. Kim Ballestrin, National Sales Manager
Ms. Lyn Lyons, Software Development

Minicomp is a major Australian distributor for Cromemco. Services include installation, integration, software support, professional training and software development. We also offer a wide range of peripherals and software compatible with Cromemco systems. We take great pride in providing fast efficient service and support.

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South Melbourne, Victoria 3205
Australia
(03) 690-2899, telex AA30458
84-86 Pacific Highway
St. Leonards, New South Wales 2065
Australia
(02) 439-3788

Australia's largest Cromemco suppliers, with a staff of 18, providing professional services in all areas of computer implementation.

Key Personnel: Dr. Simon Rosenbaum, Managing Director
Norman Rosenbaum, General Manager
Tony Benci, Sales Manager
Ian Holland, Senior Programmer
Sue Stevenson, Sydney Sales

Major Market Area: Australia wide. Dealers in QLD and TAS.

USD SUPERCOPY II FOR TM-848 DRIVES

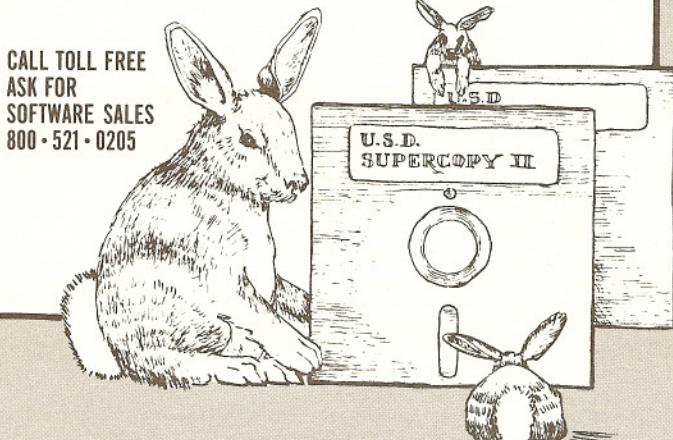
Supercopy II, version 1.42, is now available for use with Cromemco's 8-inch TM-848 drives, and 5-inch TM-100 drives.

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Update for previous Supercopy II owners \$49.00

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ENVIRONMETRICS

(National Library of Australia card number and ISBN 0 9590809 0 2)

The C-10 FUN DISK is designed as a menu driven package of games, educational programs, utilities and access to the pixel resolution graphics of the C-10. It is intended to assist the business user of the C-10 to obtain maximum benefit for his machine by providing a carefully graded set of lessons in BASIC programming and by providing a key with which to unlock the C-10 graphics. At the same time, the FUN DISK will provide amusement and education for the business person's family through a variety of games offered on the disk.

The FUN DISK menu consists of nine choices:

- 1: HELP
- 2: THE BASIC PRIMER—an introduction to the BASIC language in eight lessons.
- 3: THE BASIC TEACHER—a simple guide to programming.
- 4: CLOCK—sets and displays the C-10 clock.
- 5: Structured Basic programming language.
- 6: GALACTIC WORMS—An exciting game utilizing C-10 Graphics.
- 7: EASEL—allows you to use C-10 graphics.
- 8: Rabbit, Camel, Wumpus or Rotate ; use the Beeper or do sums. — Games programs and educational programs.
- 9: Return to System Disk.

THE C-10 FUN DISK is available for \$100 from:

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Written inquiries can be sent to:
Bobby Nojima, 5225 Marconi Avenue,
Carmichael, CA 95608

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SPECIAL OF THE MONTH

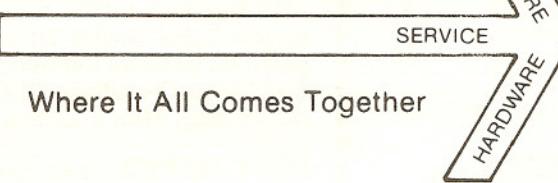
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**COMPUTER CROSSROADS
of AMERICA, INC.**



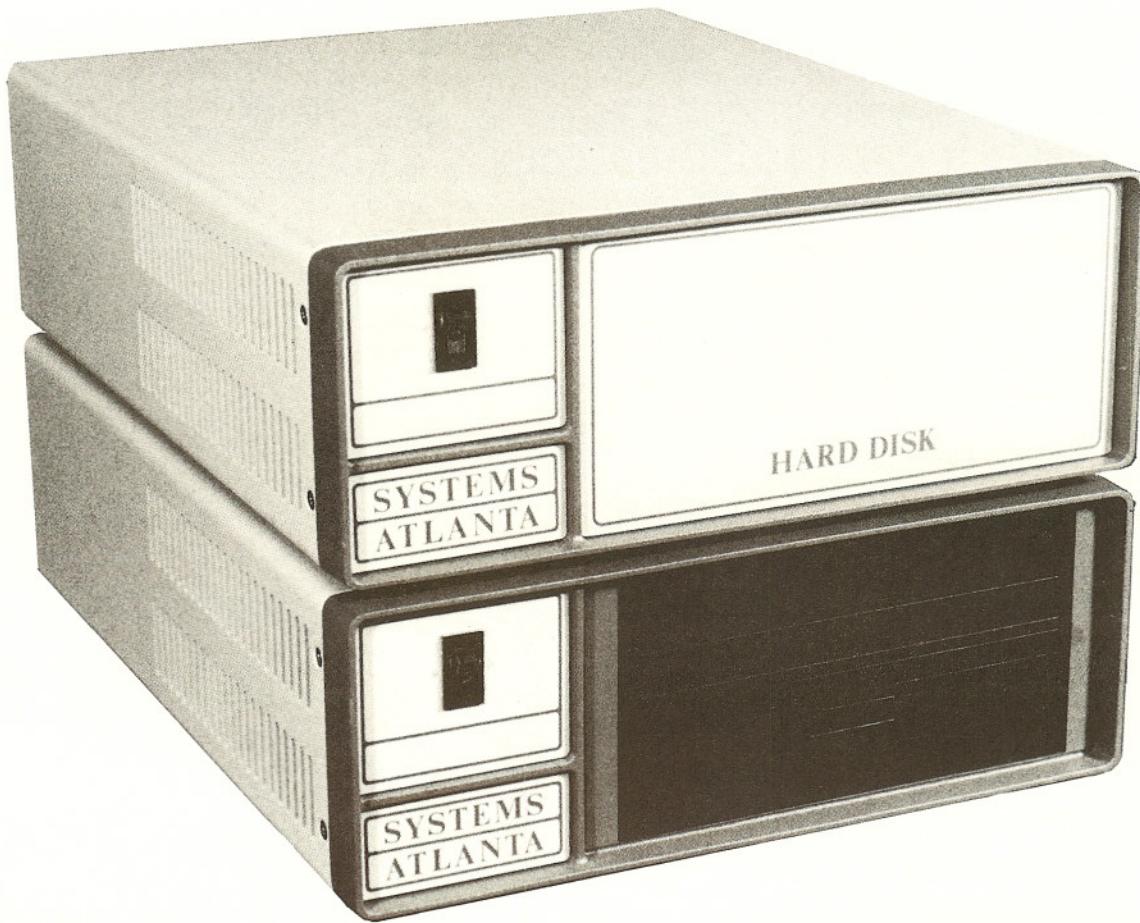
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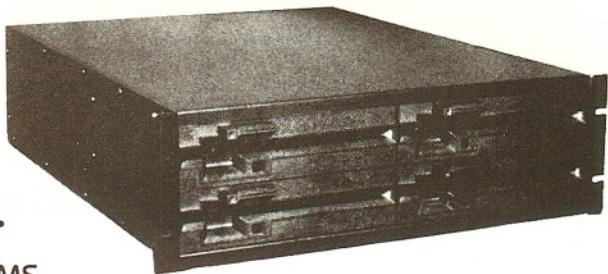
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Cromemco computers can make UNIX System V even better. Because our systems are designed with UNIX in mind. First of all, we offer UNIX System V with Berkeley enhancements. Then, our hardware uses advanced features like 64K of on-board cache memory and our high speed STDC controller to speed up disk operations—very important with UNIX.

More capability and expandability

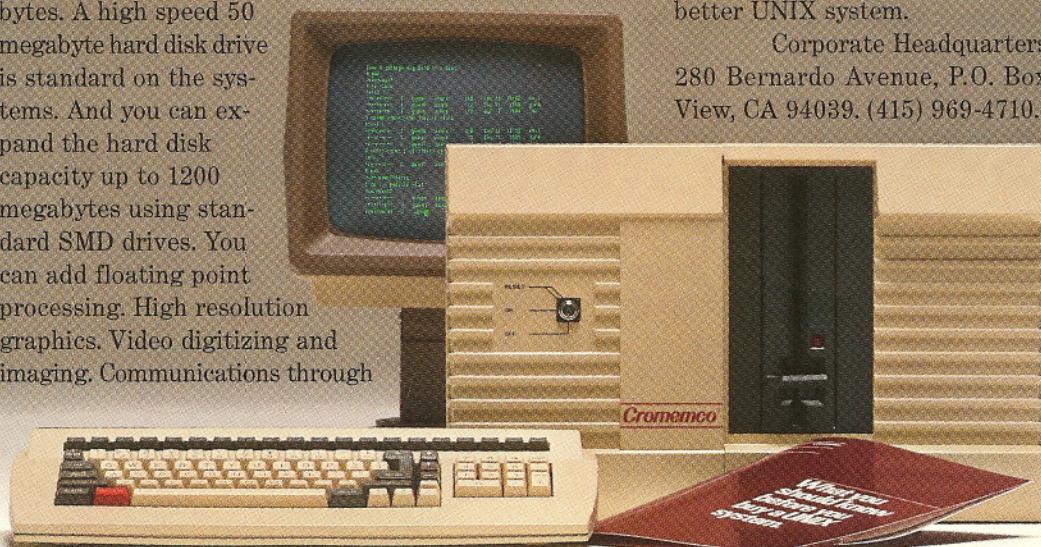
We have a high-speed, 68000-based CPU that runs at 10 MHz, coupled with a memory manager that uses demand-paging and scatter loading to work *with* UNIX, not for it.

We provide room for expanding RAM to 16 megabytes—with error detection and correction—for running even the most sophisticated and advanced microcomputer programs. And the power to accommodate up to 16 users—all with plenty of memory.

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And software support is here to meet your needs. We offer major programming languages, database management systems, communications software, including SNA architecture, X.25 protocol, and Ethernet; even a program to interface to an IBM PC if you need to. And, of course, access to the broad range of standard UNIX applications programs that is growing dramatically every day.

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We also make our systems easier to use, because we install the operating system before we ship your computer. No complicated installation procedures. And the Berkeley enhancements give you the standard UNIX System V operating system, but with the added convenience of these widely acclaimed improvements.

Cromemco's System 100 and System 300 computers: designed to be the highest performance UNIX systems available anywhere.

Just call or visit one of our UNIX System V Official System Centers to see for yourself. They'll also give you a copy of our new publication, "What you should know before you buy a UNIX system." Or contact us directly.

We'll be glad to show you how to get a better UNIX system.

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